PROJECT MANUAL

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FOR

LATHROP-MANTECA
FIRE
DISTRICT
LATHROP, CALIFORNIA

FIRE STATION #31
REHABILITATION

LATHROP, CALIFORNIA

16 November 2020

LDA Partners
DESIGNERS & ARCHITECTS

PROJECT MANUAL

FOR

LATHROP-MANTECA FIRE DISTRICT

FIRE STATION # 31
REHABILITATION
LATHROP, CALIFORNIA

GENERAL CONDITIONS

Refer to City of Lathrop Standard Specifications

SPECIFICATIONS

SECTION 01 00 10 - DEFINITIONS

PART 1 - GENERAL

1.01 Architect

A. Architect shall mean LDA Partners, Inc.

1.02 CONSTRUCTION MANAGER / PROJECT MANAGER

A. Construction Manager or Project Manager shall mean the designated Construction or Project Manager by the Lathrop-Manteca Fire District.

1.03 DISTRICT / CITY / OWNER

A. District, City or Owner shall mean the Lathrop-Manteca Fire District.

1.04 COUNTY

A. County shall mean The County of San Joaquin.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01 11 00 - SUMMARY OF WORK

PART 1 - GENERAL

1.01 The work herein to be performed by the Contractor consists of constructing and completing the "Project," as defined in the General Conditions and Requirements, in accordance with the Drawings and Specifications and all applicable provisions of the Contract Documents and the District Standard Specifications. It is intended that these plans and the City of Lathrop Standard Specifications and Details and these Special Provisions require all labor and materials necessary for the work contemplated. The Contractor shall notify the District immediately regarding any discrepancies or ambiguities which may exist in the Plans, Specifications and Special Provisions. The District's interpretation or correction thereof shall be conclusive.

1.02 The "Project" shall generally consist of construction of a partial remodel of the existing building and roof replacement as described in the Plans and Specifications entitled FIRE STATION #31, Lathrop, CA. Lathrop-Manteca Fire District.

A. Informational Signs: At least two days in advance of any construction activity, the Contractor shall install a project information construction sign(s) 48" by 96" in size (minimum) with 4" minimum height letters, at the site where construction work is occurring. Letters shall be black on white background. Location of the sign shall be determined by the Construction Manager. Compensation for this item shall be included in the base bid. Information on the sign shall include the name of the Owner, the Architect and his Consultants, Contractor, funding source, and a twenty-four hour telephone number. An elevation graphic to be inserted into the signage will be supplied by the Architect.

B. The "Work" as described in these specifications shall generally consist of all work specified, indicated, shown or contemplated in the contract to construct the improvements.

C. Order and furnish all labor, materials, supplies, tools, and transportation and perform all operations in connection with and reasonably incidental to complete the installation of the project.

D. Official bid documents including plans and specifications may be acquired at the local builder's exchange. Any fees required are the responsibility of the Bidder. All bids submitted for this project must conform to the requirements of the official bid documents, including plans and specifications.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01 14 00 - WORKING CONDITIONS

PART 1 - GENERAL

1.01 Description

A. Attention is directed to AIA document 201 and the Example Professional Services Agreement included within the Bid Documents and these Special Provisions.

B. The Contractor shall not shut down any part of the existing services without prior authorization from the District or it's Agents. After the completion of specific work, all electric, water, gas, or telephone services temporarily disconnected shall be immediately restored.

C. The Construction Manager shall assign to the Contractor at the pre-construction meeting allowable areas for the storage of construction materials and for the use by workmen and the limits of the work assigned to him.

D. The Contractor shall be responsible for obtaining City, County, State or Federal permits, licenses, certificates, approvals prior to and for the completion of the work. All applicable provisions of OSHA regarding Occupational Safety and Health Administration Code shall be adhered to.

E. All work under this contract will be under the control and inspection of the County, or his appointed representatives. Any and all construction comments by other forces shall be referred to the Architect.

F. The contractor shall protect any existing turf/landscaping and site appurtenances to remain. The contractor shall be responsible for the repair of all damages to the satisfaction of the District representative.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01 20 00 - PRICE & PAYMENT PROCEDURES

PART 1 - GENERAL

1.01 Schedule of Values: A schedule of values to show breakdown of Contract corresponding with payment request breakdown and progress schedule line items is required for this project. The Items of Work Schedule shall be the basis of the schedule of values. The Contractor shall expand and/or modify this schedule as directed by the Construction Manager. The line item breakdown of the schedule of values shall be subject to approval by the District representative. Schedule of values shall be submitted within ten (10) days of the Notice to Proceed. The Items of Work Schedule is shown in Appendix A.

1.02 Payment Requests: Submit request for payment as outlined in the contract or as below:

A. Prior to initial payment request, submit:

1. Schedule of values
2. Progress schedule
3. Payroll records
4. DAS-140 forms

B. Contractor may submit final payment request, provided the following have been completed:

1. Submit warranties and similar documentation
2. Signed Mechanics' Lien release, or other proof of final payment, from each subcontractor
3. Submit maintenance manuals and provide instruction of District's operational/maintenance personnel.
4. Complete final punch list and cleaning of the work.
5. Attend post construction meeting.
6. Issuance of a Certificate of Occupancy

C. The contract lump sum price paid for each bid item shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in each of the items, as shown on the plans, as specified in the District & County Standard Specifications and these special provisions, and the Project Manual, and as directed by the Construction Manager and Architect. Items not specifically listed but necessary for a full and complete installation of the work (e.g. mobilization, construction staking, erosion and sediment control, etc.) shall be considered incidental to the items listed and no separate payment for such items shall be made. The Construction Manager's determination of what items are to be included in the category of "necessary for a full and complete installation of the work" shall be final.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01 26 00 - CONTRACT MODIFICATION PROCEDURES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.

1.03 CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing Changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions." Contractor overhead & profit percentages shall be limited to 10% for all Change Orders. This shall include deductive amounts, and shall also apply to subcontractors.

1.04 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
   1. Proposal Requests issued by Architect are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
   2. Within time specified in Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
      a) Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
      b) Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
      c) Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change.
   1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
   2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.

3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

C. Proposal Request Form: Use AIA Document G709 for Proposal Requests.

1.05 ALLOWANCES

A. Allowance Adjustment: To adjust allowance amounts, base each Change Order proposal on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place.
1. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.
2. Submit substantiation of a change in scope of work, if any, claimed in Change Orders related to unit-cost allowances.
3. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.

B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the Purchase Order amount or Contractor's handling, labor, installation, overhead, and profit. Submit claims within 21 days of receipt of the Change Order or Construction Change Directive authorizing work to proceed. Owner will reject claims submitted later than 21 days after such authorization.

1.06 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Proposal Request, the Construction Manager will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

1.07 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Construction Manager may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF SECTION

SECTION 01 31 19 - PROJECT MEETINGS AND SCHEDULES

PART 1 - GENERAL

1.01 Pre-construction Meeting: The Contractor shall contact the Construction Manager, 72 hours prior to starting the project to arrange for a pre-construction meeting.

1.02 Periodic Meetings: Periodic job site meetings may be requested by the Construction Manager and Architect to review modifications or conflicts in the Work. The Contractor shall attend such meetings and shall require subcontractors to attend as necessary and/or as requested.

1.03 Project Schedule:

A. Immediately upon awarding of the contract, and at the time of the pre-construction meeting, the Contractor shall prepare and submit to the Construction Manager six (6) copies of the revised construction schedule. The schedule shall be in a form acceptable to the Construction Manager showing the proposed date of commencement and completion of each of the various subdivisions or units of work required under this Contract. Items on the schedule shall be arranged in the order and sequence in which they will be performed. The schedule shall conform to the working time and time of completion established under the terms of the Contract and shall be subject to modification by and approval by the Construction Manager. When, in the opinion of the Construction Manager it becomes necessary to accelerate the work, the Contractor, when so ordered, shall modify the schedule to conform to such requirements.

1.04 Estimate of Cost

A. The Contractor shall also furnish periodic itemized estimates of work done for the purpose of making payments thereon. The estimates shall list the items and percentage of completion of each line item in the approved schedule of values.

1.05 Post Construction Meeting

A. The Contractor may be required to attend a post construction meeting that will be arranged by the District representative after completion of work and prior to acceptance and final payment. The project Architect and the project inspector shall attend this meeting. The purpose of the meeting will be to discuss the project and any related issues that can help improve future construction projects.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01 32 00 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Preliminary Construction Schedule.
2. Contractor's Construction Schedule.
3. Submittals Schedule.
4. Field condition reports.
5. Special reports.

B. Related Sections include the following:
1. Division 1 Section 01330 "Submittal Procedures" for submitting schedules and reports.

1.03 SUBMITTALS

A. Qualification Data: For firms and persons specified in "Quality Assurance" Article and in-house scheduling personnel to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

B. Preliminary Construction Schedule: Submit five printed copies.

C. Contractor's Construction Schedule: Submit five printed copies of initial schedule, large enough to show entire schedule for entire construction period.

D. CPM Reports: Concurrent with CPM schedule, submit five printed copies of each of the following computer-generated reports. Format for each activity in reports shall contain activity number, activity description, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float.

1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
3. Total Float Report: List of all activities sorted in ascending order of total float.

E. Field Condition Reports: Submit two copies at time of discovery of differing conditions.

F. Special Reports: Submit two copies at time of unusual event.

1.04 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.

B. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from parties involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 PRODUCTS

2.01 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Substantial Completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

B. Activities: Treat each separate area as a separate numbered activity for each principal element of the Work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
2. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
3. Submittal Review Time: Include review and resubmittal times indicated in Division 1 Section 01330 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.
4. Startup and Testing Time: Include not less than 14 days for startup and testing.
5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.

C. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion.

D. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using fragments to demonstrate the effect of the proposed change on the overall project schedule.

2.02 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

A. CPM Schedule: Prepare Contractor's Construction Schedule using a CPM network analysis diagram.

1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 30 days after date established for the Notice to Proceed.
2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
4. Use "one workday" as the unit of time.

B. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the preliminary network diagram, prepare a skeleton network to identify probable critical paths.

1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:

    a) Preparation and processing of submittals.
    b) Delivery.
    c) Fabrication.
    d) Installation.

2. Processing: Process data to produce output data or a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
3. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.

    a) Subnetworks on separate sheets are permissible for activities clearly off the critical path.

C. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:

1. Identification of activities that have changed.
2. Changes in early and late start dates.
3. Changes in early and late finish dates.
4. Changes in activity durations in workdays.
5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in the Contract Time.

2.03 REPORTS

A. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare a detailed report. Submit with a request for information on CSI Form 13.2A. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.04 SPECIAL REPORTS

A. General: Submit special reports directly to Construction Manager within one day of an occurrence. Distribute copies of report to parties affected by the occurrence.

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

PART 3 EXECUTION

3.01 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule two days before each regularly scheduled progress meeting.

B. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

END OF SECTION 01320

SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

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

1.03 DEFINITIONS

A. Action Submittals: Written and graphic information that requires Architect's and Construction Manager's responsive action.

B. Informational Submittals: Written information that does not require Architect's and Construction Manager's approval. Submittals may be rejected for not complying with requirements.

1.04 SUBMITTAL PROCEDURES

A. General: Electronic copies of CAD Drawings of the Contract Drawings will not be provided by Architect for Contractor's use in preparing submittals.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
   1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
   2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
      a) Architect and Construction Manager reserve the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Submittals Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.

D. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Construction Manager's receipt of submittal.
   1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. Construction Manager will advise Contractor when a submittal being processed must be delayed for coordination.
   2. If intermediate submittal is necessary, process it in same manner as initial submittal.
   3. Allow 15 days for processing each resubmittal.

4. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing.

E. Identification: Place a permanent label or title block on each submittal for identification.
   1. Indicate name of firm or entity that prepared each submittal on label or title block.
   2. Include the following information on label for processing and recording action taken:
      a) Project name.
      b) Date.
      c) Name and address of Contractor.
      d) Name and address of subcontractor.
      e) Name and address of supplier.
      f) Name of manufacturer.
      g) Unique identifier, including revision number.
      h) Number and title of appropriate Specification Section.
      i) Drawing number and detail references, as appropriate.
      j) Other necessary identification.

F. Deviations: Highlight, encircle, or otherwise identify deviations from the Contract Documents on submittals.

G. Additional Copies: Unless additional copies are required for final submittal, and unless Architect or Construction Manager observes noncompliance with provisions of the Contract Documents, initial submittal may serve as final submittal.
   1. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect and Construction Manager.
   2. Additional copies submitted for maintenance manuals will not be marked with action taken and will be returned.

H. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect and Construction Manager will return submittals, without review, received from sources other than Contractor.
   1. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect and Construction Manager on previous submittals, and deviations from requirements of the Contract Documents, including minor variations and limitations. Include the same label information as the related submittal.
   2. Include Contractor's certification stating that information submitted complies with requirements of the Contract Documents.

I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

J. Use for Construction: Use only final submittals with mark indicating action taken by Architect and Construction Manager in connection with construction.

PART 2 PRODUCTS

2.01 ACTION SUBMITTALS

A. General: Prepare and submit Action Submittals required by individual Specification Sections.

1. Number of Copies: Submit six copies of each submittal, unless otherwise indicated. Architect, through Construction Manager, will return four copies. Mark up and retain one returned copy as a Project Record Document.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
   1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
   2. Include the following information, as applicable:
      a) Manufacturer's written recommendations.
      b) Manufacturer's product specifications.
      c) Manufacturer's installation instructions.
      d) Color charts.
      e) Manufacturer's catalog cuts.
      f) Wiring diagrams showing factory-installed wiring.
      g) Printed performance curves.
      h) Operational range diagrams.
      i) Mill reports.
      j) Standard product operating and maintenance manuals.
      k) Compliance with recognized trade association standards.
      l) Compliance with recognized testing agency standards.
      m) Application of testing agency labels and seals.
      n) Notation of coordination requirements.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
   1. Preparation: Include the following information, as applicable:
      a) Dimensions.
      b) Identification of products.
      c) Fabrication and installation drawings.
      d) Roughing-in and setting diagrams.
      e) Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
      f) Shopwork manufacturing instructions.
      g) Templates and patterns.
      h) Schedules.
      i) Design calculations.
      j) Compliance with specified standards.
      k) Notation of coordination requirements.
      l) Notation of dimensions established by field measurement.
   2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm) but no larger than 30 by 40 inches (750 by 1000 mm).
   3. Number of Copies: Submit six blue- or black-line prints of each submittal, unless prints are required for operation and maintenance manuals. Submit six prints where prints are required for operation and maintenance manuals. Architect and Construction Manager will retain three prints; remainder will be returned. Mark up and retain one returned print as a Project Record Drawing.

D. Samples: Prepare physical units of materials or products, including the following:
   1. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

2. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
   a) Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

2.02 INFORMATIONAL SUBMITTALS

A. General: Prepare and submit Informational Submittals required by other Specification Sections.
   1. Number of Copies: Submit six copies of each submittal, unless otherwise indicated. Architect and Construction Manager will not return copies.
   2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
   3. Test and Inspection Reports: Comply with requirements in Division 1 Section "Quality Requirements."

B. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.

C. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements.

D. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements.

E. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements in Division 1 Section "Closeout Procedures Operation and Maintenance Data."

F. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.

PART 3 EXECUTION

3.01 CONTRACTOR'S REVIEW

A. Review each submittal and check for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect and Construction Manager.

B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of

reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.02 ARCHITECT'S AND CONSTRUCTION MANAGER'S ACTION

A. General: Architect and Construction Manager will not review submittals that do not bear Contractor's approval stamp and will return them without action.
   1. Action Submittals: Architect and Construction Manager will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect and Construction Manager will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken.

B. Submittals not required by the Contract Documents will not be reviewed and may be discarded.

END OF SECTION

SECTION 01 35 00 - SPECIAL CONDITIONS

PART 1 – GENERAL

1.01 Description

A. This work shall be done in accordance with the City of Lathrop , Standard Specifications and Details insofar as the same may apply and in accordance with the following Special Provisions. To the extent the Department of Transportation Standard Specifications implement the STATE CONTRACT ACT they shall not be applicable since the City of Lathrop is not subject to said ACT.

B. In case of conflict between the Standard specifications and these Special Provisions, the Special Provisions shall take precedence over and be used in lieu of such conflicting portions.

C. In the event of conflict between latest County adopted editions of the governing codes (Uniform Building Code, National Electric Code, Uniform Fire Code, Uniform Plumbing Code and Uniform Mechanical Code) and others as applicable, and the Standard Specifications and the Special Provisions, the governing code requirements shall take precedence.

D. Existing Facilities: The Contractor shall protect all existing facilities from damage. It shall be the responsibilities of the Contractor to ascertain their exact location and to protect them from damage. Any existing utilities damaged due to the Contractor's operation shall be repaired to the satisfaction of the Construction Manager at no additional cost to the District.

E. The Contractor shall notify the Construction Manager forty-eight (48) hours in advance of any construction.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01 40 00 - PROCEDURES AND QUALITY CONTROL

PART 1 – GENERAL

1.01 Progress Schedule

A. Progress schedule shall be required for this project and shall conform to the provisions of these Special Provisions.

1.02 Installation

A. General: Comply with manufacturer's instructions and recommendations. Clean and protect to ensure that products, materials and equipment will be free from damage and deterioration at time of acceptance.

B. Installer Cooperation: Require installer of each major unit of work to inspect substrate and conditions for installation, and to report (in writing) unsatisfactory conditions. Correct unsatisfactory conditions before proceeding. Inspect each product immediately before installation, and do not install damaged or defective products, materials or equipment.

1.03 Cleaning and Protection:

A. General: Clean each element of work at time of installation. Provide sufficient maintenance and protection during construction to ensure freedom from damage and deterioration at time of substantial completion.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01 45 00 - PRODUCT HANDLING

PART 1 – GENERAL

1.01 Work included: Protect products schedule for use in the work by means including, but not necessarily limited to, those described in this Section. Quality Assurance: Include within the Contractor's quality assurance program such procedures as are required to assure full protection of work and materials.

1.02 Manufacturer's Recommendations: Except as otherwise approved by the Construction Manager or Architect, determine and comply with manufacturers' recommendation on product handling, storage, and protection.

1.03 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 District.

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

1.04 Repairs and Replacements

A. In event of damage, promptly make replacements and repairs to the approval of the Construction Manager and at no additional cost to the District.

B. Additional time required to secure replacements and to make repairs will not be considered by the Construction Manager to justify an extension in the Contract Time of Completion.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes requirements for temporary facilities and controls, including temporary utilities, support facilities, and security and protection facilities.

B. Temporary utilities include, but are not limited to, the following:
   1. Water service and distribution.
   2. Sanitary facilities, including toilets, wash facilities, and drinking-water facilities.
   3. Electric power service.
   4. Lighting.
   5. Telephone /internet service.

C. Support facilities include, but are not limited to, the following:
   1. Temporary roads and paving.
   2. Dewatering facilities and drains.
   3. Project identification and temporary signs.
   4. Waste disposal facilities.
   5. Field offices.
   6. Storage and fabrication sheds.
   7. Construction aids and miscellaneous services and facilities.

D. Security and protection facilities include, but are not limited to, the following:
   1. Environmental protection.
   2. Stormwater control.
   3. Tree and plant protection.
   4. Site enclosure fence.
   5. Security enclosure and lockup.
   6. Barricades, warning signs, and lights.
   7. Fire protection.

1.03 USE CHARGES

A. General: Cost or use charges for temporary facilities are not chargeable to Owner or Architect and shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, the following:
   1. Owner's construction forces.
   2. Occupants of Project.
   3. Architect.
   4. Testing agencies.
   5. Personnel of authorities having jurisdiction.

1.04 QUALITY ASSURANCE

A. Standards: Comply with ANSI A10.6, NECA's "Temporary Electrical Facilities," and NFPA 241.
   1. Trade Jurisdictions: Assigned responsibilities for installation and operation of temporary utilities are not intended to interfere with trade regulations and union jurisdictions.
   2. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.05 PROJECT CONDITIONS

A. Temporary Utilities: At earliest feasible time, when acceptable to Owner, change over from use of temporary service to use of permanent service.
   1. Temporary Use of Permanent Facilities: Installer of each permanent service shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

B. Conditions of Use: The following conditions apply to use of temporary services and facilities by all parties engaged in the Work:
   1. Keep temporary services and facilities clean and neat.
   2. Relocate temporary services and facilities as required by progress of the Work.

PART 2 PRODUCTS

2.01 MATERIALS

A. General: Provide new materials. Undamaged, previously used materials in serviceable condition may be used if approved by Architect. Provide materials suitable for use intended.

B. Portable Chain-Link Fencing: Minimum 2-inch (50-mm) 9-gage, galvanized steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts, with 1-5/8-inch- (42-mm-) OD top and bottom rails. Provide galvanized steel bases for supporting posts.

C. Water: Potable.

2.02 EQUIPMENT

A. General: Provide equipment suitable for use intended.

B. Field Offices: Mobile units with lockable entrances, operable windows, and serviceable finishes; heated and air conditioned; on foundations adequate for normal loading. Contractor may use unoccupied area of the existing building for his field office, upon approval of the Construction Manager.

C. Fire Extinguishers: Hand carried, portable, UL rated. Provide class and extinguishing agent as indicated or a combination of extinguishers of NFPA-recommended classes for exposures.

1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

D. Self-Contained Toilet Units: Single-occupant units of chemical, aerated recirculation, or combustion type; vented; fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.

E. Drinking-Water Fixtures: Containerized, tap-dispenser, bottled-water drinking-water units, including paper cup supply.
   1. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 45 to 55 deg F (7.2 to 12.7 deg C).

F. Electrical Outlets: Properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-V plugs into higher-voltage outlets; equipped with ground-fault circuit interrupters, reset button, and pilot light. There is existing power to the facility. The Contractor may use existing power connections for construction of the facility. Contractor is required to provide power as required during all electrical service transfers and shutdowns.

PART 3 EXECUTION

3.01 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.

B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.02 TEMPORARY UTILITY INSTALLATION

A. General: Engage appropriate local utility company to install temporary service or connect to existing service. Where utility company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with utility company recommendations. There is existing power to the facility. The Contractor may use existing power connections for construction of the facility. Contractor is required to provide power as required during all electrical service transfers and shutdowns.

   1. Arrange with utility company, and Owner for time when service can be interrupted, if necessary, to make connections for temporary services.
   2. Provide adequate capacity at each stage of construction. Before temporary utility is available, provide trucked-in services.
   3. Obtain easements to bring temporary utilities to Project site where Owner's easements cannot be used for that purpose.

B. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction until permanent water service is in use. There is existing water service to the building. The Contractor may use the existing water connection for construction purposes. Water meter must be replaced. The Contractor is to supply water as required during shutdown of existing service during change-over.
   1. Provide rubber hoses as necessary to serve Project site.

2. Where installations below an outlet might be damaged by spillage or leakage, provide a drip pan of suitable size to minimize water damage. Drain accumulated water promptly from pans.

C. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking-water fixtures. Comply with regulations and health codes for type, number, location, operation, and maintenance of fixtures and facilities.
   1. Disposable Supplies: Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Maintain adequate supply. Provide covered waste containers for disposal of used material.
   2. Wash Facilities: Install wash facilities supplied with potable water at convenient locations for personnel who handle materials that require wash up. Dispose of drainage properly. Supply cleaning compounds appropriate for each type of material handled.

D. Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload-protected disconnecting means, automatic ground-fault interrupters, and main distribution switchgear.
   1. Connect temporary service to Owner's existing power source, as directed by electric company officials.

E. Electric Distribution: Provide receptacle outlets adequate for connection of power tools and equipment.
   1. Provide waterproof connectors to connect separate lengths of electrical power cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.
   2. Provide warning signs at power outlets other than 110 to 120 V.

F. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations and traffic conditions.
   1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

G. Telephone Service: Provide temporary telephone service throughout construction period for common-use facilities used by all personnel engaged in construction activities. Install separate telephone line for each field office and first-aid station.
   1. Provide additional telephone lines for the following:
      a) Provide a dedicated telephone line for a facsimile machine.
   2. At each telephone, post a list of important telephone numbers.
      a) Police and fire departments.
      b) Ambulance service.
      c) Contractor's home office.
      d) Architect's office.
      e) Owner's office.
      f) Principal subcontractors' field and home offices.
   3. Provide voice-mail service on superintendent's telephone.

3.03 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:
   1. Locate field offices, storage sheds, sanitary facilities, and other temporary construction and support facilities for easy access.

2. Maintain support facilities until near Substantial Completion. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Containerize and clearly label hazardous, dangerous, or unsanitary waste materials separately from other waste.
   1. If required by authorities having jurisdiction, provide separate containers, clearly labeled, for each type of waste material to be deposited.
   2. Develop a waste management plan for Work performed on Project. Indicate types of waste materials Project will produce and estimate quantities of each type. Provide detailed information for on-site waste storage and separation of recyclable materials. Provide information on destination of each type of waste material and means to be used to dispose of all waste materials.

3.04 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects. Avoid using tools and equipment that produce harmful noise. Restrict use of noisemaking tools and equipment to hours that will minimize complaints from persons or firms near Project site.

B. Stormwater Control: Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of stormwater from heavy rains.

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

D. Site Enclosure Fence: When excavation begins, install portable chain-link enclosure fence with lockable entrance gates. Locate where indicated, or enclose entire Project site or portion determined sufficient to accommodate construction operations. Install in a manner that will prevent people, dogs, and other animals from easily entering site except by entrance gates.
   1. Set fence posts in concrete bases.
   2. Provide gates in sizes and at locations necessary to accommodate delivery vehicles and other construction operations.
   3. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Provide Owner with two sets of keys. Provide list of personnel with keys.

E. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.

F. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erecting structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and public of possible hazard. Where appropriate and needed, provide lighting, including flashing red or amber lights.
   1. For safety barriers, sidewalk bridges, and similar uses, provide minimum 5/8-inch-(16-mm-) thick exterior plywood.

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

3.05 OPERATION, TERMINATION, AND REMOVAL

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

B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage caused by freezing temperatures and similar elements.
   1. Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.

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

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

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01 57 23 - STORM WATER POLLUTION PREVENTION PLAN IMPLEMENTATION

PART 1– GENERAL

1.01 Scope

A. The contractor shall be responsible for preparing and submitting a Storm Water Pollution Prevention Plan (SWPPP). Contractor shall submit the SWPPP to the District representative within fifteen (15) working days of award of the contract by the District. The submittal shall contain the following:

1. Vicinity Map (can be copied from the bid specification package);

SWPPP (prepared by contractor.

B. Prior to, or concurrently, the District will file the Notice of Intent (NOI) with the State Water Resources Control Board, and will present a copy of the NOI to the contractor when accepted by the State. The contractor shall keep a complete copy of the SWPPP and the NOI on the construction site at all times.

C. The Contractor shall perform all operations and provide all equipment and materials necessary for complete and continuous implementation of the SWPPP as shown on the drawings and per the submitted forms.

1.02 Standards

All work shall conform to the requirements set forth in the State Water Resources Control Board. (SWRCB), Order No 99-08-DWQ, National Pollutant Discharge Elimination System (NPDES) General Permit No. CAS000002, Waste Discharge Requirements (WDRS) for Discharges of Storm Water Runoff, associated with construction activity. In particular, the contractor's attention is directed to Section B: Monitoring program and reporting requirements and Section C: Standard Provisions for Construction activity.

1.04 Notice of Termination

A. Upon completion of the substantial completion review, the contractor shall prepare for the District's signature, a SWRCB Notice of Termination (NOT) of coverage under the NPDES General Permit No. CAS 000002 for Discharges of Storm Water Associated with Construction Activity.

PART 2 – PRODUCTS

2.01 Materials

A. All materials used for implementation of the SWPPP shall be new and they shall be of a manufacturer, type, and quality generally accepted for storm water pollution prevention by the construction industry.

PART 3 – EXECUTION

Install, execute, and monitor all storm water pollution prevention activities per the SWPPP as shown on the drawings.

END OF SECTION

SECTION 01 60 00 - MATERIALS AND EQUIPMENT

PART 1 – GENERAL

1.01 The Contractor shall furnish all materials and/or equipment needed to complete the work and installations required under the terms of the Contract; exclusive of such materials and/or equipment specifically designated to be furnished and/or installed by the District or under separate Contract.

A. The Contractor shall submit satisfactory evidence of compliance with the specifications of such materials and/or equipment to be furnished under the Contract and/or to be incorporated in to the work, as the Construction Manager may require.

1.02 Trade Names

A. Whenever in these Specifications or on the Drawings the name or brand of manufactured article is used it is intended to indicate a measure of quality and utility or a standard.

1.03 Quality

A. Both materials and workmanship shall be first quality; all of which shall be subject to the review of the Construction Manager. Materials shall be new and free from either factory, shop or field applied trade signs or advertising labels exposed to view in the finished work, except only as specified for certain identification work and/or only necessary to identify fire-rated materials or construction.

1.04 Substitutions

A. Within ten (10) days after the “Notice to Proceed,” the Contractor shall submit for record and information a complete list of all materials which differ in any respect from materials specified and all materials which are proposed for use in work of this Contract and which are not specifically mentioned in the Specifications.

B. Specific Requirements: The Construction Manager will consider proposals for substitution of materials, equipment and/or methods only when such proposals are accompanied by full and complete technical data and other information required by the Construction Manager to evaluate the proposed substitution. Proposals submitted without complete data will not be considered. Do not substitute materials, equipment and/or methods unless such substitution has been specifically approved for the work by the Construction Manager or Architect. The Architect will be the sole authority of approval or disapproval of substitutions.

C. Unavailability of Equipment or Materials: Substitution for specified equipment or materials may be proposed by the Contractor if the specified equipment or materials cannot be delivered and incorporated in the work in the time allowed due to conditions beyond the control of the Contractor. Each request for substitution shall include a statement of cause with substantiating documents as proof of quality, delivery time, and costs in the form of certified quotations from suppliers of both specified and proposed material. Request shall be proposed and submitted as required below.

PART 2 – PRODUCTS (NOT USED)
PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01 70 00 - PROJECT CLOSEOUT

PART 1 - GENERAL

1.01 Related Documents

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

1.02 Summary

A. This Section specifies administrative and procedural requirements for project closeout, including but not limited to:

1. Inspection procedures.
2. Project record document submittal.
3. Operating and maintenance manual submittal.
4. Submittal of warranties.
5. Final cleaning.

B. Closeout requirements for specific construction activities are included in the appropriate Sections in Divisions-2 through -16.

1.03 Substantial Completion

Preliminary Procedures: Before requesting inspection for certification of Substantial Completion, complete the following. List exceptions in the request.

1. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.

   a. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.

2. Advise Owner of pending insurance change-over requirements.

3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.

4. Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities; include occupancy permits, operating certificates and similar releases.
5. Submit record drawings, maintenance manuals, final project photographs, damage or settlement survey, property survey, and similar final record information.

6. Deliver tools, spare parts, extra stock, and similar items.

7. Make final change-over of permanent locks and transmit keys to the Owner. Advise the Owner's personnel of change-over in security provisions.

8. Complete start-up testing of systems, and instruction 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.
9. Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.

Inspection Procedures: On receipt of a request for inspection, the Construction Manager will either proceed with inspection or advise the Contractor of unfilled requirements. The Construction Manager will prepare the Certificate of Substantial Completion following inspection, or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.

1. The Construction Manager will repeat inspection when requested and assured that the Work has been substantially completed.

2. Results of the completed inspection will form the basis of requirements for final acceptance.

1.04 Final Acceptance

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

1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.

2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.

3. Submit a certified copy of the Construction Manager 's final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, and the list has been endorsed and dated by the Architect.

4. Submit 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.

5. Submit consent of surety to final payment.

6. Submit a final liquidated damages settlement statement.

7. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

B. Reinspection Procedure: The Construction Manager and Architect will reinspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed, except items whose completion has been delayed because of circumstances acceptable to the Architect.

1. Upon completion of reinspection, the Construction Manager will prepare a certificate of final acceptance, or advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.

2. If necessary, reinspection will be repeated.

1.05 Record Document Submittals

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

B. Record Drawings: Refer to Section 01781 “Project Record Documents”.

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

1. Upon completion of the Work, submit record Specifications to the Construction Manager for the Owner's records.

D. Record Product Data: Maintain one copy of each Product Data submittal. Mark these documents to show significant variations in actual Work performed in comparison with information submitted. Include variations in products delivered to the site, and from the manufacturer's installation instructions and recommendations. Give particular attention to concealed products and portions of the Work which cannot otherwise be readily discerned later by direct observation. Note related Change Orders and mark-up of record drawings and Specifications.

1. Upon completion of mark-up, submit complete set of record Product Data to the Construction Manager for the Owner's records.

E. Record Sample Submitted: Immediately prior to the date or dates of Substantial Completion, the Contractor will meet at the site with the Engineer and the Owner's personnel to determine which of the submitted Samples that have been maintained during progress of the Work are to be transmitted to the Owner for record purposes. Comply with delivery to the Owner's Sample storage area.

F. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record-keeping and submittals in connection with actual performance of the Work. Immediately prior to the date or dates of Substantial Completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for continued use and reference. Submit to the Engineer for the Owner's records.

G. Maintenance Manuals: Organize operating and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual heavy-duty 2-inch, 3-ring vinyl-covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder. Include the following types of information:

1. Emergency instructions.
2. Spare parts list.
3. Copies of warranties.

4. Wiring diagrams.
5. Recommended "turn around" cycles.
6. Inspection procedures.
7. Shop Drawings and Product Data.
8. Fixture lamping schedule.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 Closeout Procedures

A. Operating and Maintenance Instructions: Arrange for each installer of equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. If installers are not experienced in procedures, provide instruction by manufacturer's representatives. Include a detailed review of the following items:

1. Maintenance manuals.
2. Record documents.
3. Spare parts and materials.
4. Tools.
5. Lubricants.
6. Fuels.
7. Identification systems.
8. Control sequences.
9. Hazards.
10. Cleaning.
11. Warranties and bonds.
12. Maintenance agreements and similar continuing commitments.

B. As part of instruction for operating equipment, demonstrate the following procedures:

1. Start-up.
2. Shutdown.
3. Emergency operations.
4. Noise and vibration adjustments.
5. Safety procedures.
6. Economy and efficiency adjustments.
7. Effective energy utilization.

3.02 Final Cleaning

A. General: General cleaning during construction is required by the General Conditions and included in Section "Temporary Facilities".

B. Cleaning: Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions.

1. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion.
   a. Remove labels that are not permanent labels.

   b. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compound and other substances that are

noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.

c. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films and similar foreign substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.

d. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.

e. Clean the site, including landscape development areas, of rubbish, litter and other foreign substances. Sweep paved areas broom clean; remove stains, spills and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth even-textured surface.

C. Removal of Protection: Remove temporary protection and facilities installed for protection of the Work during construction.

D. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner.

1. Where extra materials of value remaining after completion of associated Work have become the Owner's property, arrange for disposition of these materials as directed.

END OF SECTION

SECTION 01 73 29 - CUTTING AND PATCHING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes procedural requirements for cutting and patching.

B. Related Sections include the following:

1. Division 1 Section "Selective Demolition" for demolition of selected portions of the building for alterations.
2. Divisions 2 through 50 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
3. Construction Drawings.

1.03 DEFINITIONS

A. Cutting: Removal of existing construction necessary to permit installation or performance of other Work.

B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.04 QUALITY ASSURANCE

A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio, U.O.N.

B. Operational Elements: Do not cut and patch the following operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.

1. Primary operational systems and equipment.
2. Fire-protection systems.
3. Control systems.
4. Electrical wiring systems.

C. Miscellaneous Elements: Do not cut and patch the following elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety, U.O.N.

1. Water, moisture, or vapor barriers.
2. Membranes and flashings.
3. Piping, ductwork, vessels, and equipment.

D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

E. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades, as applicable. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

PART 2 PRODUCTS

2.01 MATERIALS

A. General: Comply with requirements specified in other Sections of these Specifications and the Drawings.

B. Existing Materials: Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of existing materials.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.

1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut. Shoring shall be “design build” by Contractor.

B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

3.03 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut existing construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Cutting: Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
5. Proceed with patching after construction operations requiring cutting are complete.

C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

a) Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

END OF SECTION

SECTION 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 -GENERAL

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.

2. SUMMARY

a) Section includes administrative and procedural requirements for the following:

Salvaging nonhazardous demolition and construction waste.
Recycling nonhazardous demolition and construction waste.
Disposing of nonhazardous demolition and construction waste.

b) Related Requirements:
Section 024119 "Selective Demolition" for disposition of waste resulting from partial demolition of buildings, structures, and site improvements.
Section 042000 "Unit Masonry" for disposal requirements for masonry waste.
Section 311000 "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

3. DEFINITIONS

a) Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

b) Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

c) Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

d) Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

e) Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

4. PERFORMANCE REQUIREMENTS

a) General: Achieve end-of-Project rates for salvage/recycling of 50 percent by weight of total non-hazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means

to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials, including the following:

Demolition Waste:

Asphalt paving.
Concrete.
Concrete reinforcing steel.
Brick.
Concrete masonry units.
Wood studs.
Wood joists.
Plywood and oriented strand board.
Wood paneling.
Wood trim.
Structural and miscellaneous steel.
Rough hardware.
Roofing.
Insulation.
Doors and frames.
Door hardware.
Windows.
Glazing.
Metal studs.
Gypsum board.
Acoustical tile and panels.
Carpet.
Carpet pad.
Demountable partitions.
Equipment.
Cabinets.
Plumbing fixtures.
Piping.
Supports and hangers.
Valves.
Sprinklers.
Mechanical equipment.
Refrigerants.
Electrical conduit.
Copper wiring.
Lighting fixtures.
Lamps.
Ballasts.
Electrical devices.
Switchgear and panelboards.
Transformers.

Construction Waste:

Masonry and CMU.
Lumber.
Wood sheet materials.
Wood trim.
Metals.
Roofing.

Insulation.
Carpet and pad.
Gypsum board.
Piping.
Electrical conduit.

Packaging: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:

Paper.
Cardboard.
Boxes.
Plastic sheet and film.
Polystyrene packaging.
Wood crates.
Plastic pails.

5. ACTION SUBMITTALS

a) Waste Management Plan: Submit plan within 7 days of date established for the Notice to Proceed.

6. INFORMATIONAL SUBMITTALS

a) Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Use Form CWM-7 for construction waste. Include the following information:

Material category.
Generation point of waste.
Total quantity of waste in tons (tonnes).
Quantity of waste salvaged, both estimated and actual in tons (tonnes).
Quantity of waste recycled, both estimated and actual in tons (tonnes).
Total quantity of waste recovered (salvaged plus recycled) in tons (tonnes).
Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

b) Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.

c) Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.

d) Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.

e) Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

f) Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

g) Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

7. QUALITY ASSURANCE

a) Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

b) Waste Management Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:

Review and discuss waste management plan including responsibilities of waste management coordinator.
Review requirements for documenting quantities of each type of waste and its disposition.
Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
Review waste management requirements for each trade.

8. WASTE MANAGEMENT PLAN

a) General: Develop a waste management plan according to ASTM E 1609 and requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

b) Waste Identification: Indicate anticipated types and quantities of construction waste generated by the Work. Use Form CWM-1 for construction waste. Include estimated quantities and assumptions for estimates.

c) Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Use Form CWM-3 for construction waste. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.

Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

d) Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Use Form CWM-5 for construction waste. Include the following:

Total quantity of waste.
Estimated cost of disposal (cost per unit). Include hauling and tipping fees and cost of collection containers for each type of waste.
Total cost of disposal (with no waste management).
Revenue from salvaged materials.
Revenue from recycled materials.
Savings in hauling and tipping fees by donating materials.
Savings in hauling and tipping fees that are avoided.
Handling and transportation costs. Include cost of collection containers for each type of waste.
Net additional cost or net savings from waste management plan.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

1. PLAN IMPLEMENTATION

a) General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

Comply with operation, termination, and removal requirements in Section 015000 "Temporary Facilities and Controls."

b) Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.

Distribute waste management plan to everyone concerned within 7 days of submittal return.
Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

c) Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

2. SALVAGING DEMOLITION WASTE

a) Salvaged Items for Reuse in the Work: Salvage items for reuse and handle as follows:

Clean salvaged items.
Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
Store items in a secure area until installation.
Protect items from damage during transport and storage.
Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

b) Salvaged Items for Donation: Not permitted on Project site.

c) Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.

d) Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.

e) Plumbing Fixtures: Separate by type and size.

f) Lighting Fixtures: Separate lamps by type and protect from breakage.

g) Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

3. RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

a) General: Recycle paper and beverage containers used by on-site workers.

b) Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

c) Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.

Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.

Inspect containers and bins for contamination and remove contaminated materials if found.

Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
Stockpile materials away from construction area. Do not store within drip line of remaining trees.

Store components off the ground and protect from the weather.
Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

4. RECYCLING DEMOLITION WASTE

a) Asphalt Paving: Break up and transport paving to asphalt-recycling facility.

b) Concrete: Remove reinforcement and other metals from concrete and sort with other metals.

c) Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.

Clean and stack undamaged, whole masonry units on wood pallets.

d) Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.

e) Metals: Separate metals by type.

Structural Steel: Stack members according to size, type of member, and length.
Remove and dispose of bolts, nuts, washers, and other rough hardware.

f) Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.

g) Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.

h) Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.

i) Metal Suspension System: Separate metal members including trim, and other metals from acoustical panels and tile and sort with other metals.

j) Carpet Tile: Remove debris, trash, and adhesive.

Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.

k) Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.

l) Conduit: Reduce conduit to straight lengths and store by type and size.

5. RECYCLING CONSTRUCTION WASTE

a) Packaging:

Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
Polystyrene Packaging: Separate and bag materials.
Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

b) Wood Materials:

Clean Cut-Offs of Lumber: Grind or chip into small pieces.
Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

c) Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.

6. DISPOSAL OF WASTE

a) General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

b) Burning: Do not burn waste materials.

c) Disposal: Remove waste materials from Owner's property and legally dispose of them.

7. ATTACHMENTS (APPENDIX A)

a) Form CWM-1 for construction waste identification.

b) Form CWM-2 for demolition waste identification.

c) Form CWM-3 for construction waste reduction work plan.

d) Form CWM-4 for demolition waste reduction work plan.

e) Form CWM-5 cost/revenue analysis of construction waste reduction work plan.

f) Form CWM-6 cost/revenue analysis of demolition waste reduction work plan.

g) Form CWM-7 for construction waste

h) Form CWM-8 for demolition waste.

END OF SECTION

SECTION 01 78 39 - PROJECT RECORD DOCUMENTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

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

1. Record Drawings.

1.03 SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit one set of marked-up Record Prints. Submit one copy of Record CAD Drawings.

PART 2 PRODUCTS

2.01 RECORD DRAWINGS

A. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.

1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.

a) Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
b) Accurately record information in an understandable drawing technique.
c) Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.

2. Content: Types of items requiring marking include, but are not limited to, the following:

a) Dimensional changes to Drawings.
b) Locations and depths of underground utilities.
c) Revisions to routing of piping and conduits.

d) Revisions to electrical circuitry.
e) Actual equipment locations.
f) Duct size and routing.
g) Locations of concealed internal utilities.
h) Changes made following Architect's written orders.

3. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record CAD Drawings: Immediately before inspection for Certificate of Substantial Completion, review marked-up Record Prints with Architect. Prepare a full set of corrected CAD Drawings of the Contract Drawings, as follows:

1. Format: .DWG, Version, AutoCAD 2014, operating in Microsoft Windows operating system, or approved equal.
2. Incorporate changes and additional information previously marked on Record Prints. Delete, redraw, and add details and notations where applicable.
3. Architect will furnish Contractor one set of CAD Drawings of the Contract Drawings for use in recording information.

a) Architect makes no representations as to the accuracy or completeness of CAD Drawings as they relate to the Contract Drawings.
b) CAD Software Program: The Contract Drawings are available in AutoCAD Architectural Desktop, R2i electronic format, Microsoft Windows Operating System.

C. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize Record Prints and newly prepared Record Drawings into manageable sets. Include identification on cover sheets.
2. Record CAD Drawings: Organize CAD information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each CAD file.
3. Identification: As follows:

a) Project name.
b) Date.
c) Designation "PROJECT RECORD DRAWINGS."
d) Name of Architect.
e) Name of Contractor.

PART 3 EXECUTION

3.01 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.

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

END OF SECTION

SECTION 01 93 00 - MAINTENANCE

PART 1 – GENERAL

1.01 The Contractor shall perform all operations necessary for, and properly incidental to, cleanup during construction, and final site cleanup prior to the acceptance of the project by the District.

1.02 Cleanup During Construction

A. During construction phases of the work the Contractor shall keep dust and debris to a minimum. In no instance shall dust and debris be permitted beyond the limits of the construction. The Contractor shall use all necessary measures to reduce the impact on District personnel at other areas of the building and the Construction Manager may, at any time during construction, order a general cleanup of the project as part of the work under this Section.

B. Contractor shall dispose of waste, trash, and debris in a safe, acceptable manner, in accordance with applicable laws and ordinances and as prescribed by authorities having jurisdiction. Burying of such waste material and debris on the site will not be permitted. Burning of trash and debris on the site will not be permitted.

C. Location of dump for trash and debris and length of haul is the Contractor's responsibility.

1.03 Final Site Cleaning: Prior to final inspection, thoroughly clean the entire area and put into a neat, acceptable condition. Remove from the entire site all construction waste and used materials, dunnage, and all debris of any description resulting from the work.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 02 41 16 - DEMOLITION AND DISPOSAL

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:
   1. Demolition and removal of selected portions of a building or structure.
   2. Demolition and removal of selected site elements.

B. Related Sections include the following:
   1. Division 1 Section "Construction Progress Documentation" for preconstruction photographs taken before selective demolition.
   2. Division 1 Section "Temporary Facilities and Controls" for temporary construction and environmental-protection measures for selective demolition operations.
   3. Division 1 Section "Cutting and Patching" for cutting and patching procedures for selective demolition operations.
   4. Division 2 Section "Site Clearing" for site clearing and removal of above- and below-grade improvements.
   5. Division 2-50 Sections for demolishing, cutting, patching, or relocating all other items.
   6. Division 1 – Construction Waste Management

1.03 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.

B. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.04 MATERIALS OWNERSHIP

A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, demolished materials shall become Contractor's property and shall be removed from Project site.

1.05 SUBMITTALS

A. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

B. Proposed Dust-Control and Noise-Control Measures: Submit statement or drawing that indicates the measures proposed for use, proposed locations, and proposed time frame

for their operation. Identify options if proposed measures are later determined to be inadequate.

C. Schedule of Selective Demolition Activities: Indicate the following:
   1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
   2. Interruption of utility services.
   3. Coordination for shutoff, capping, and continuation of utility services.
   4. Locations of temporary partitions and means of egress.
   5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

D. Predemolition Photographs: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by selective demolition operations. Submit before Work begins.

1.06 QUALITY ASSURANCE

A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.

B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

C. If the Contractor or any of the Contractor’s agents or employees encounters or discovers materials that appear (by visual or olfactory inspection) to contain regulated or hazardous materials (as defined by the California Environmental Protection Agency) during the performance of the Work, the Contractor shall inform the Engineer immediately and suspend work in the affected area until the Engineer has inspected the location and materials in question. If it becomes necessary to undertake remediation, the Engineer will give written notice to suspend work in the affected area until the proper course of action has been determined. Operations in the affected area shall be resumed only upon written notice by the Engineer.

D. Standards: Comply with ANSI A10.6 and NFPA 241.

E. Predemolition Conference: Conduct conference at Project site. Review methods and procedures related to selective demolition including, but not limited to, the following:
   1. Inspect and discuss condition of construction to be selectively demolished.
   2. Review structural load limitations of existing structure.
   3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
   4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.

1.07 PROJECT CONDITIONS

A. Maintain access to existing walkways and other adjacent occupied or used facilities.
   1. Do not close or obstruct walkways or other occupied or used facilities without written permission from authorities having jurisdiction.

B. Owner assumes no responsibility for condition of areas to be selectively demolished.
   1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
   2. Before selective demolition, Owner will remove the following items:
      a) All equipment, included conditioning apparatus, and telescoping bleachers.

C. Storage or sale of removed items or materials on-site will not be permitted.

D. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
   1. Maintain fire-protection facilities in service during selective demolition operations.

PART 2 PRODUCTS

PART 1. 2.01 FILL MATERIALS

PART 2. A. Fill material used to fill and/or cap underground pipes and structures.

PART 3. 1. Cement slurry mix shall be in conformance with “Section 19-3.02D: Slurry Cement Backfill” of the Caltrans Standard Specifications and shall consist of a fluid, workable mixture of aggregate, cement, and water. Slurry cement backfill shall be 2-sack mix, containing 188 pounds of Portland cement per cubic yard of material.

PART 4. 2. Other fill material as approved by the Engineer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that utilities have been disconnected and capped.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

C. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

D. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.02 UTILITY SERVICES

A. Existing Utilities: Maintain services indicated to remain and protect them against damage during selective demolition operations.

B. Do not interrupt existing utilities serving occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and to authorities having jurisdiction.
   1. Provide at least 48 hours' notice to Owner if shutdown of service is required during changeover.

C. Utility Requirements: Refer to relative sections for shutting off, disconnecting, removing,

and sealing or capping utilities. Do not start selective demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.03 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
   1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.
   2. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.
   3. Protect existing site improvements, appurtenances, and landscaping to remain.
   4. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
   1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
   2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
   3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
   4. Cover and protect furniture, furnishings, and equipment that have not been removed.

C. Temporary Enclosures: Provide temporary enclosures for protection of existing building and construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
   1. Where heating or cooling is needed and permanent enclosure is not complete, provide insulated temporary enclosures. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.

D. Temporary Partitions: Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.

E. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of construction to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
   1. Strengthen or add new supports when required during progress of selective demolition.

3.04 POLLUTION CONTROLS

A. Dust Control: Use water mist, temporary enclosures, and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations.
   1. Do not use water when it may damage existing construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

2. Wet mop floors to eliminate trackable dirt and wipe down walls and doors of demolition enclosure. Vacuum carpeted areas.

B. Disposal: Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
   1. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

C. Cleaning: Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

3.05 SELECTIVE DEMOLITION

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
   1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
   2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
   3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
   4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
   5. Maintain adequate ventilation when using cutting torches.
   6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
   7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
   8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
   9. Dispose of demolished items and materials promptly.
   10. Return elements of construction and surfaces that are to remain to condition existing before selective demolition operations began.

B. Existing Facilities: Comply with District's requirements for using and protecting other building facilities during selective demolition operations.

C. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

D. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

E. Carpet and Resilient Floor Coverings: Remove floor coverings and adhesive according

to recommendations in RFCI-WP and its Addendum.

1. Remove residual adhesive and prepare substrate for new floor coverings by one of the methods recommended by RFCI.

F. Roofing: Remove no more existing roofing than can be covered in one day by new roofing. Refer to applicable Division 7 Section for new roofing requirements.

3.06 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

END OF SECTION

SECTION 02 51 40 - PORTLAND CEMENT CONCRETE PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete sidewalks, curbs, gutters, utility slabs, parking areas, driveways, driveway aprons and approaches.

B. Concrete pavement striping.

C. Concrete wheel stops.

1.02 WORK INSTALLED BUT FURNISHED UNDER OTHER SECTIONS

A. Section 02 63 00 - Storm Drainage Systems: Drainage grates and frames.

1.03 REFERENCES

A. ACI 301 - Specifications for Structural Concrete for Buildings.

B. ANSI/ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.

C. ANSI/ASTM D1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction.

D. ASTM A615 - Deformed and Plain Billet-Steel for Concrete Reinforcement.

E. ASTM C33 - Concrete Aggregates.

F. ASTM C94 - Ready Mixed Concrete.

G. ASTM C150 - Portland Cement.

H. ASTM C260 - Air Entraining Admixtures for Concrete.

I. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.

1.04 QUALITY ASSURANCE

A. Perform work in accordance with ACI 301.

B. Obtain materials from same source throughout.

C. Refer to soils report for information concerning soils at the site.

1.05 REGULATORY REQUIREMENTS

A. Conform to applicable code for paving work on public property.

1.06 TESTS

A. Testing and analysis will be performed under provisions of this contract.

B. Submit proposed mix design to testing laboratory for review prior to commencement of work.

C. Owner's Inspector or Testing firm will take cylinders and perform slump tests in accordance with ACI 301.

1.07 SUBMITTALS

A. Submit product data.

B. Include data on joint filler and curing compounds.

C. Submit manufacturer's instructions.

PART 2 PRODUCTS

2.01 CONCRETE MATERIALS

A. Cement: ASTM C150 Normal-Type I Portland type, gray color.

B. Fine and Coarse Aggregates: ASTM C33.

C. Water: Clean and not detrimental to concrete.

2.02 FORM MATERIALS

A. Conform to ACI 301.

B. Joint Filler: ANSI/ASTM D1751, 1/4 inch thick, manufactured by J & P Petroleum Products, Inc., or Progress Unlimited, Inc.

2.03 REINFORCEMENT

A. Reinforcing Steel: ASTM A706; 60 ksi yield grade; deformed billet steel bars, uncoated finish.

B. Welded Steel Wire Fabric: Plain type, ANSI/ASTM A185; in coiled rolls; uncoated finish.

C. Tie Wire: Annealed steel, minimum 16 gage size.

D. Dowels: ASTM A706; 60 ksi yield grade, plain steel, uncoated finish.

2.04 ACCESSORIES

A. Curing Compound: ASTM C309, type 1-D.

B. Preformed Joint: ASTM D1751, 1/4" thick.

2.05 ADMIXTURES

A. Air Entrainment: ASTM C260.

2.06 CONCRETE MIX

A. Mix concrete in accordance with ASTM C94.

B. Provide concrete of the following characteristics:

1. Driveways, Drive Aisles, Aprons and Approaches: Compromise strength of 3,000 psi at 28 days.

2. Sidewalks, Curbs, Gutters and Utility Slabs: Compressive Strength of 2,500 psi at 28 days.

C. Add air entraining agent to concrete mix for concrete work exposed to exterior.

2.07 PAVEMENT STRIPING PAINT

A. Provide chlorinated rubber-alkyd type, white color, except at handicapped spaces, blue color equal to color no. 15090 per federal standard 595B.

B. Acceptable Products:

1. "Traffic Paint" manufactured by Kelly-Moore Paint Co.

2. "Traffic Paint" manufactured by Mercury Paint Co.

3. "Traffic and Zone Marking Paint" manufactured by PPG.

2.08 CONCRETE WHEEL STOPS

A. Prefabricated 5-1/2" H. x 7-1/2" W. x 48" L. 3,500 psi concrete wheel stops, fully reinforced complete with anchor pins, where required.

B. Acceptable manufactures.

1. Plan-it Company of Saf-T-Park Company.

2. Consley & Montegny.

3. Substitutions: Under provisions of this contract.

PART 3 EXECUTION

3.01 INSPECTION

A. Verify compacted sub grade is ready to support paving and imposed loads.

B. Verify gradients and elevations of base are correct.

C. Beginning of installation means acceptance of existing conditions.

3.02 PREPARATION

A. Moisten base to minimize absorption of water from fresh concreting operations.

B. Notify Architect a minimum of 24 hours prior to commencement of concreting operations.

3.03 FORMING

A. Place and secure forms to correct location, dimension, and profile.

B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.

C. Place joint fillers vertical in position, in straight lines. Secure to formwork during concrete placement.

3.04 REINFORCEMENT

A. Place reinforcement at mid-height of slabs-on-grade.

B. Interrupt reinforcement at joints.

C. Place reinforcement to achieve slab and curb alignment as detailed.

3.05 FORMED JOINTS

A. Place expansion joints at 24 foot intervals to correct elevation and profile. Align curb, gutter, and sidewalk joints.

B. Place joint filler between paving components and building or other appurtenances.

C. Provide scored joints at indicated intervals of sidewalk.

3.06 PLACING CONCRETE

A. Place concrete in accordance with ACI 301.

B. Hot Weather Placement: ACI 301.

C. Cold Weather Placement: ACI 301.

D. Ensure reinforcement, inserts, embedded parts, and formed joints are not disturbed during concrete placement.

E. Place concrete continuously between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.

F. Place concrete to pattern indicated. Saw cut contraction joints 3/16 inch wide at an optimum time after finishing. Cut 1/3 into depth of slab.

G. The concrete shall be mixed and placed as specified for 2,500 p.s.i. or 3,000 p.s.i. concrete in this Section. The surfaces shall be finished in the manner specified in Article 3.8. Joint and edges shall be tooled.

H. Exterior concrete slabs and paving shall be poured in panels approximately 400 sq. ft. in area.

3.07 EXPANSION AND CONTROL JOINTS

A. Sidewalks and covered passage slabs shall be built with expansion joints where shown on drawings, or as follows: Expansion joints for sidewalks shall be spaced approximately every 10' in each direction, maximum. Expansion joints shall be provided at all covered passage intersections, passages with each other and with other concrete, at all corners of buildings and walks.

B. Expansion joint material shall be of durable elastic compound so prepared that it will retain its required form during the placing of concrete. When compressed to half its thickness it shall return to 70% of its original thickness. Expansion joints shall extend entirely through the slab and be in one piece for the width of the slab.

C. Control Joints: provide 1-1/2" deep saw cut 16 to 20 hours after pour, centered between expansion joints or as shown on plans.

3.08 FINISHING

A. Driveway Paving: Medium broom for slopes less than 5% and heavy broom finish for slopes greater than 5%.

B. Sidewalk Paving: Medium broom finish at surfaces less than 5% slope and heavy broom finish for slopes greater than 5%. Radius and trowel joint edges.

C. Curbs and Gutters: Medium broom finish at surfaces less than 5% slope and heavy broom finish for slopes greater than 5%. Radius and trowel joint edges.

D. At joints and markings, round off top edge of the slab with 1/4 inch edging tool.

E. Place curing compound on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.

3.09 PAVEMENT STRIPING

A. Lay out line markings and other painting in accordance with Drawings. Lines shall be 4 inches wide.

B. Clean surfaces to be painted. Apply paint in accordance with manufacturer's directions only when weather conditions permit proper application. Machine apply paint in as many coats as are required to provide opaque markings.

3.10 CONCRETE WHEEL STOPS

A. Place wheel stops at all parking stalls as indicated.

B. Anchor permanently in place in accordance with manufacturer's directions with epoxy adhesive.

3.11 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed.

3.12 PROTECTION

A. Immediately after placement, protect concrete under provisions of Section 01500 from premature drying, excessive hot or cold temperatures, and mechanical injury.

END OF SECTION

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1. RELATED DOCUMENTS

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

2. SUMMARY

   a) Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:

      Footings.

      Slabs-on-grade.

   b) Related Sections:

      Section 32 13 00 "Concrete Paving" for concrete pavement and walks.

3. DEFINITIONS

   a) Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

4. ACTION SUBMITTALS

   a) Product Data: For each type of product indicated.

   b) Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

      Indicate amounts of mixing water to be withheld for later addition at Project site.

   c) Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

5. INFORMATIONAL SUBMITTALS

   a) Material Certificates: For each of the following, signed by manufacturers:

Cementitious materials.
Admixtures.
Form materials and form-release agents.
Steel reinforcement and accessories.
Curing compounds.
Floor and slab treatments.
Bonding agents.
Adhesives.
Vapor retarders.
Semirigid joint filler.
Joint-filler strips.
Repair materials.

b) Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:

Aggregates.

c) Field quality-control reports.

6. QUALITY ASSURANCE

a) Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

b) Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

c) Testing Agency Qualifications: An independent agency, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

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

e) Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."

f) ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

ACI 301, "Specifications for Structural Concrete," Sections 1 through 5.
ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

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

7. DELIVERY, STORAGE, AND HANDLING

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

PART 2 PRODUCTS

1. STEEL REINFORCEMENT

a) Recycled Content of Steel Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.

b) Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

c) Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.

2. REINFORCEMENT ACCESSORIES

a) Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, cut true to length with ends square and free of burrs.

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

For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

3. CONCRETE MATERIALS

a) Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

Portland Cement: ASTM C 150, Type I/II

Fly Ash: ASTM C 618, Class F
Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

Blended Hydraulic Cement: ASTM C 595, Type IS, portland blast-furnace slag Type IP, portland-pozzolan cement.

b) Silica Fume: ASTM C 1240, amorphous silica.

c) Normal-Weight Aggregates: ASTM C 33 coarse aggregate or better, graded. Provide aggregates from a single source

Maximum Coarse-Aggregate Size: 1 inch (25 mm) nominal.
Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

d) Water: ASTM C 94/C 94M and potable.

4. ADMIXTURES

a) Air-Entraining Admixture: ASTM C 260.

b) Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
Retarding Admixture: ASTM C 494/C 494M, Type B.
Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

5. FLOOR AND SLAB TREATMENTS

a) Slip-Resistive Emery Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive, crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials with 100 percent passing 3/8-inch sieve.

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

Anti-Hydro International, Inc.; Emery.
Dayton Superior Corporation; Emery Tuff Non-Slip.
Lambert Corporation; EMAG-20.
L&M Construction Chemicals, Inc.; Grip It.
Metalcrete Industries; Metco Anti-Skid Aggregate.

b) Emery Dry-Shake Floor Hardener: Unpigmented, factory-packaged, dry combination of portland cement, graded emery aggregate, and plasticizing admixture; with emery aggregate consisting of no less than 60 percent of total aggregate content.

6. CURING MATERIALS

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

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

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

b) Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.

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

d) Water: Potable.

e) Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

Products: Subject to compliance with requirements, provide the following

Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
BASF Construction Chemicals - Building Systems; Kure 200.
ChemMasters; Safe-Cure Clear.
Conspec by Dayton Superior; W.B. Resin Cure.
Dayton Superior Corporation; Day-Chem Rez Cure (J-11-W).
Edoco by Dayton Superior; Res X Cure WB.
Euclid Chemical Company (The), an RPM company; Kurez W VOX; TAMMSCURE WB 30C.
Kaufman Products, Inc.; Thinfilm 420.
Lambert Corporation; AQUA KURE - CLEAR.
L&M Construction Chemicals, Inc.; L&M Cure R.
Meadows, W. R., Inc.; 1100-CLEAR.
Nox-Crete Products Group; Resin Cure E.
Right Pointe; Clear Water Resin.

SpecChem, LLC; Spec Rez Clear.
Symons by Dayton Superior; Resi-Chem Clear.
TK Products, Division of Sierra Corporation; TK-2519 DC WB.
Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100.

7. RELATED MATERIALS

a) Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

b) Bonding Agent: ASTM C 1059/C 1059M, Type II, non-re-dispersible, acrylic emulsion or styrene butadiene.

8. CONCRETE MIXTURES, GENERAL

a) Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

b) Cementitious Materials: Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.

Fly Ash: 25 percent.
Combined Fly Ash and Pozzolan: 25 percent.
Ground Granulated Blast-Furnace Slag: 50 percent.
Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
Silica Fume: 10 percent.
Combined Fly Ash, Pozzolans, and Silica Fume: 35 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
Combined Fly Ash or Pozzolans, Ground Granulated Blast-Furnace Slag, and Silica Fume: 50 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.

c) Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

d) Admixtures: Use admixtures according to manufacturer's written instructions.

Use high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
Use corrosion-inhibiting admixture in concrete mixtures where indicated.

e) Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

9. FABRICATING REINFORCEMENT

a) Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

10. CONCRETE MIXING

a) Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M, and furnish batch ticket information.

When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

b) Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.

For mixer capacity of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
For mixer capacity larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).
Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 EXECUTION

1. FORMWORK

a) Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

b) Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

c) Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
Class B, 1/4 inch (6 mm) for rough-formed finished surfaces.

d) Construct forms tight enough to prevent loss of concrete mortar.

e) Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

Install keyways, reglets, recesses, and the like, for easy removal.
Do not use rust-stained steel form-facing material.

f) Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

g) Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

h) Do not chamfer exterior corners and edges of permanently exposed concrete.

i) Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

j) Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

k) Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

l) Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

2. EMBEDDED ITEMS

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

Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
Install dovetail anchor slots in concrete structures as indicated.

3. STEEL REINFORCEMENT

a) General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

b) Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

c) Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.

d) Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

e) Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

f) Epoxy-Coated Reinforcement: Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M. Use epoxy-coated steel wire ties to fasten epoxy-coated steel reinforcement.

g) Zinc-Coated Reinforcement: Repair cut and damaged zinc coatings with zinc repair material according to ASTM A 780. Use galvanized steel wire ties to fasten zinc-coated steel reinforcement.

4. JOINTS

a) General: Construct joints true to line with faces perpendicular to surface plane of concrete.

b) Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

5. WATERSTOPS

a) Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.

b) Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

6. CONCRETE PLACEMENT

a) Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

b) Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

c) Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

d) Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

e) Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
Maintain reinforcement in position on chairs during concrete placement.
Screed slab surfaces with a straightedge and strike off to correct elevations.
Slope surfaces uniformly to drains where required.

Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

f) Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

g) Hot-Weather Placement: Comply with ACI 301 and as follows:

Maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

7. FINISHING FORMED SURFACES

a) Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

Apply to concrete surfaces not exposed to public view.

b) Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

Apply to concrete surfaces exposed to public view

8. FINISHING FLOORS AND SLABS

a) General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

b) Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

Apply a trowel finish to surfaces exposed to view.

Finish surfaces to the following tolerances, according to ASTM E 1155 (ASTM E 1155M), for a randomly trafficked floor surface:

Specified overall values of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and of levelness, F(L) 15.
Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.
Specified overall values of flatness, F(F) 30; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 15; for suspended slabs.
Specified overall values of flatness, F(F) 45; and of levelness, F(L) 35; with minimum local values of flatness, F(F) 30; and of levelness, F(L) 24.

Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- (3.05-m-) long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/4 inch (6 mm)

c) Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.

Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

d) Slip-Resistive Finish: Before final floating, apply slip-resistive aggregate finish where indicated and to concrete stair treads, platforms, and ramps. Apply according to manufacturer's written instructions and as follows:

Uniformly spread 25 lb/100 sq. ft. (12 kg/10 sq. m) of dampened slip-resistive aggregate over surface in one or two applications. Tamp aggregate flush with surface, but do not force below surface.
After broadcasting and tamping, apply float finish.
After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive aggregate.

9. CONCRETE PROTECTING AND CURING

a) General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

b) Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

c) Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

d) Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

e) Cure concrete according to ACI 308.1, by one or a combination of the following methods:

Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

Water.
Continuous water-fog spray.
Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.

Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.

Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer

Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

10. FIELD QUALITY CONTROL

a) Testing and Inspecting: Owner will engage a special inspector to perform field tests and inspections and prepare test reports.

b) Testing and Inspecting: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

c) Inspections:

Steel reinforcement placement.
Steel reinforcement welding.
Headed bolts and studs.
Verification of use of required design mixture.
Concrete placement, including conveying and depositing.
Curing procedures and maintenance of curing temperature.
Verification of concrete strength before removal of shores and forms from beams and slabs.

d) Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. (76 cu. m) or fraction thereof of each concrete mixture placed each day.

When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.
Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
Compression Test Specimens: ASTM C 31/C 31M.

Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
Cast and field cure two sets of two standard cylinder specimens for each composite sample.

Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.

Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.

Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).

Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.

Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

11. PROTECTION OF LIQUID FLOOR TREATMENTS

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

END OF SECTION

SECTION 04 22 00 – CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Concrete unit masonry.
2. Reinforced unit masonry.
3. Masonry waste disposal.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 3 Section “Concrete”.
2. Division 7 Section "Flashing and Sheet Metal" for exposed sheet-metal flashing installed in masonry.
3. Division 7 Section "Joint Sealants".
4. Division 8 Section “Hollow Metal doors and Frames”.

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

1. Anchor sections of adjustable masonry anchors for connecting to structural frame installed under Division 5 Section "Structural Steel."

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

1. Steel shelf angles for unit masonry specified in Division 5 Section "Metal Fabrications."
2. Manufactured reglets in masonry joints for metal flashing specified in Division 7 Section "Flashing and Sheet Metal."
3. Hollow metal frames in unit masonry openings specified in Division 8 Section "Standard Steel Doors and Frames."

1.3 PERFORMANCE REQUIREMENTS

A. Provide unit masonry that develops the following installed compressive strengths (f'm) at 28 days.

1. For Concrete Unit Masonry: As follows, based on net area:

a. f'm = 1500 psi.

1.4 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for each different masonry unit, accessory, and other manufactured product specified.

C. Shop drawings for reinforcing detailing fabrication, bending, and placement of unit masonry reinforcing bars. Comply with ACI 315 "Details and Detailing of Concrete Reinforcement" showing bar schedules, stirrup spacing, diagrams of bent bars, and arrangement of masonry reinforcement.

D. Samples for initial selection of the following:

1. Unit masonry samples in small-scale form showing the full range of colors and textures available for each different exposed masonry unit required.
2. Colored-masonry mortar samples showing the full range of colors available.

E. Samples for verification of the following:

1. Full-size units for each different exposed masonry unit required showing the full range of exposed colors, textures, and dimensions to be expected in the completed construction.

2. Colored-masonry mortar samples for each color required showing the full range of colors expected in the finished construction. Make samples using the same sand and mortar ingredients to be used on the Project. Label samples to indicate type and amount of colorant used.
3. Accessories embedded in the masonry.

F. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to specifically identify exact materials used. Include mix proportions for mortar and grout and source of aggregates.

1. Submittal is for information only. Neither receipt of list nor acceptance of mockup constitutes approval of deviations from Contract Documents unless such deviations are specifically brought to the attention of the Architect and approved in writing.

G. Material certificates for the following, signed by manufacturer and Contractor, certifying that each material complies with requirements.

1. Each different cement product required for mortar and grout, including name of manufacturer, brand, type, and weight slips at time of delivery.
2. Each material and grade indicated for reinforcing bars.
3. Each type and size of joint reinforcement.
4. Each type and size of anchors, ties, and metal accessories.

H. Material test reports from a qualified independent testing agency, employed and paid by Contractor or manufacturer, indicating and interpreting test results relative to compliance of the following proposed masonry materials with requirements indicated:

1. Mortar complying with property requirements of ASTM C 270.
2. Grout mixes. Include description of type and proportions of grout ingredients.

3. Masonry units.

I. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.5 QUALITY ASSURANCE

A. Contractor shall employ and pay a qualified professional engineer to provide a survey and inspection of foundations for compliance with dimensional tolerances.

B. Testing Agency Qualifications: To qualify for acceptance, an independent testing agency must demonstrate to Architect's satisfaction, based on evaluation of agency-submitted criteria conforming to ASTM C 1093, that it has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work.

C. Preconstruction Testing: Employ and pay a qualified independent testing agency to perform the following preconstruction testing to establish compliance of proposed materials and construction with specified requirements:

1. Concrete Masonry Unit Test: For each different concrete masonry unit indicated, test units for strength, absorption, and moisture content per ASTM C 140.
2. Prism Test: For each type of wall construction indicated, test masonry prisms per ASTM E 447, Method B.
3. Test mortar properties per test methods of ASTM C 270.
4. Evaluate mortar composition and properties per ASTM C 780.
5. Test grout compressive strength per ASTM C 1019.

D. Single-Source Responsibility for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from one source and by a single manufacturer for each different product required.

E. Single-Source Responsibility for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

F. Mockup: Prior to installing unit masonry, construct sample wall panels to verify selections made under sample submittals and to demonstrate aesthetic effects of materials and execution. Build mockups to comply with the following requirements, using materials indicated for final unit of Work.

1. Locate mockups on site in the locations indicated or, if not indicated, as directed by Architect.
2. Build mockup of typical wall area as shown on Drawings.
3. Clean exposed faces of mockups with masonry cleaner indicated.
4. Notify Architect one week in advance of the dates and times when mockups will be constructed.
5. Protect accepted mockups from the elements with weather-resistant membrane.
6. Retain and maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

a. Acceptance of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.
b. Acceptance of mockups does not constitute approval of deviations from the Contract Documents contained in mockups, unless such deviations are specifically approved by Architect in writing.
c. When directed, demolish and remove mockups from Project site.

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

H. Continuous special inspection is required for all masonry work on this job according to CBC Section 2105.3.4, Unit Strength Method.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms, under cover, and in a dry location to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion, and other causes. If units become wet, do not install until they are in an air-dried condition.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.7 PROJECT CONDITIONS

A. Do not apply uniform floor or roof loads for at least 7 days and concentrated loads for at least 14 days after building masonry walls or columns.

B. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and mortar splatter by coverings spread on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt on completed masonry.

C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit masonry damaged by frost or freezing conditions. Comply with the following requirements:

1. Cold-Weather Construction: When the ambient temperature is within the limits indicated, use the following procedures:

    a. 40 to 32 deg F: Heat mixing water or sand to produce mortar temperatures between 40 and 120 deg F.
    b. 32 to 25 deg F: Heat mixing water and sand to produce mortar temperatures between 40 and 120 deg F. Heat grout materials to produce grout temperatures between 40 and 120 deg F. Maintain mortar and grout above freezing until used in masonry.

2. Cold-Weather Protection: When the mean daily temperature is within the limits indicated, provide the following protection:

    a. 40 to 25 deg F: Cover masonry with a weather-resistant membrane for 48 hours after construction.

3. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried out, but not less than 7 days after completion of cleaning.

D. Hot-Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 deg F and above.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements. Must be approved in writing by the Architect.

2.2 CONCRETE MASONRY UNITS

A. General: Provide shapes indicated and as follows for each form of concrete masonry unit required.

1. Provide special shapes for lintels, corners, jambs, sash, control joints, headers, bonding, and other special conditions.
2. Provide square-edged units for outside corners, except where indicated as bullnose.

B. Concrete Masonry Units: ASTM C 90 and as follows:

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength indicated below:

    a. 1900 psi average of three units, 1700 psi individual unit.

2. Weight Classification: Medium weight (78 psf, fully grouted).
3. Provide Type I, moisture-controlled units.

4. Size: Manufactured to the actual dimensions listed below (within tolerances specified in the applicable referenced ASTM specification) for the corresponding nominal sizes indicated on Drawings:

   a. 8 inch nominal: 7-5/8 inch actual.
   b. 12 inch nominal: 11-5/8 inch actual.
   c. 16 inch nominal: 15-5/8 inch actual.

5. Exposed Faces: Split-Face from Manufacturer's full color range.

   a. Where units are to be left exposed, provide color and texture matching the range represented by Architect's sample.

2.3 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Mortar Cement: ASTM C270

1. For pigmented mortars, use premixed, colored mortar cements of formulation required to produce color indicated, or if not indicated, as selected from manufacturer's standard formulations. Pigments shall not exceed 5 percent of mortar cement by weight for mineral oxides nor 1 percent for carbon black.
2. For colored-aggregate mortars, use mortar cement of natural color or white as required to produce mortar color indicated.

C. Hydrated Lime: ASTM C 207, Type S and U.B.C. Standard 21-13.

D. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207.

1. For pigmented mortars, use colored portland cement-lime mix of formulation required to produce color indicated, or if not indicated, as selected from manufacturer's standard formulations. Pigments shall not exceed 10 percent of portland cement by weight for mineral oxides nor 2 percent for carbon black.

E. Aggregate for Mortar: ASTM C 144; except for joints less than 1/4 inch, use aggregate graded with 100 percent passing the No. 16 sieve.

1. White-Mortar Aggregates: Natural white sand or ground white stone.
2. Colored-Mortar Aggregates: Natural-colored sand or ground marble, granite, or other sound stone, as required to match Architect's sample.

F. Aggregate for Grout: ASTM C 404.

G. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortars.

H. Ready-Mixed Mortar: Cementitious materials, water, and aggregate complying with requirements specified in this Article; combined with set-controlling admixtures to produce a ready-mixed mortar complying with ASTM C 1142.

I. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494, Type C, and recommended by the manufacturer for use in masonry mortar of composition indicated.

J. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMU, containing integral water repellent by same manufacturer.

K. Water: Potable.

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

1. Colored Masonry Cement:

   a. Brixment-in-Color; Essroc Materials, Inc.
   b. Centurion Colorbond; Lafarge Corporation.
   c. Lehigh Custom Color Masonry Cement; Lehigh Portland Cement Co.
   d. Flamingo Color Masonry Cement; Riverton Corporation (The).

2. Colored Portland Cement-Lime Mix:

   a. Color Mortar Blend; Glen-Gery Corporation.
   b. Centurion Colorbond PL; Lafarge Corporation.
   c. Lehigh Custom Color Portland/Lime; Lehigh Portland Cement Co.
   d. Riverton Portland Cement Lime Custom Color; Riverton Corporation (The).

3. Mortar Pigments:

   a. True Tone Mortar Colors; Davis Colors.
   b. Centurion Pigments; Lafarge Corporation.
   c. SGS Mortar Colors; Solomon Grind-Chem Services, Inc.

4. Cold-Weather Admixture:

   a. Accelguard 80; Euclid Chemical Co.
   b. Morset; Grace: W.R. Grace & Co.

5. Water-Repellent Admixture:

   a. Dry-Block Mortar Admixture; Grace: W.R. Grace & Co.

6. SIKA Grout Aid II is required for all high lift grout construction.

2.4 REINFORCING STEEL

A. Steel Reinforcing Bars: Refer to Specification Section 03300, Part 2, 2.2 “Reinforceing Materials”.

2.5 MASONRY CLEANERS

A. Job-Mixed Detergent Solution: Solution of 1/2-cup dry measure tetrasodium polyphosphate and 1/2-cup dry measure laundry detergent dissolved in 1 gal. of water.

B. Proprietary Acidic Cleaner: Manufacturer's standard-strength, general-purpose cleaner designed for removing mortar/grout stains, efflorescence, and other new construction

stains from new masonry surfaces of type indicated below without discoloring or damaging masonry surfaces; expressly approved for intended use by manufacturer of masonry units being cleaned.

1. For masonry not subject to metallic oxidation stains, use formulation consisting of a concentrated blend of surface-acting acids, chelating, and wetting agents.
2. For dark-colored masonry not subject to metallic oxidation stains, use formulation consisting of a liquid blend of surface-acting acids and special inhibitors.
3. For masonry subject to metallic oxidation stains, use formulation consisting of a liquid blend of organic and inorganic acids and special inhibitors.
4. Products: Subject to compliance with requirements, provide one of the following:

    a. 202 New Masonry Detergent; Diedrich Technologies, Inc.
    b. 200 Lime Solv; Diedrich Technologies, Inc.
    c. 202V Vana-Stop; Diedrich Technologies, Inc.
    d. Sure Klean No. 600 Detergent; ProSoCo, Inc.
    e. Sure Klean No. 101 Lime Solvent; ProSoCo., Inc.
    f. Sure Klean Vana Trol; ProSoCo, Inc.

2.6 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Add cold-weather admixture (if used) at the same rate for all mortar, regardless of weather conditions, in order to ensure that mortar color is consistent.

B. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification, for types of mortar indicated below:
1. For reinforced masonry and where indicated, use type indicated below:

    a. Type: S having a minimum comprehensive strength of 1800 psi.

D. Pigmented Mortar: Select and proportion pigments with other ingredients to produce color required.

1. Limit pigments to the following percentages of cement content by weight:

    a. For mineral oxide pigments and masonry cement mortar, not more than 5 percent.
    b. For carbon-black pigment and masonry cement mortar, not more than 1 percent.

E. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates combined with selected cementitious materials.

1. Mix to match Architect's sample.

F. Grout for Unit Masonry: Comply with ASTM C476. Use grout of consistency indicated or, if not otherwise indicated, of consistency (fine or coarse) at time of placement that will completely fill spaces intended to receive grout.

1. Use fine grout in grout spaces less than 2 inches in horizontal dimension, unless otherwise indicated.
2. Use coarse grout in grout spaces 2 inches or more in least horizontal dimension, unless otherwise indicated.
3. Grout shall have a minimum compressive strength of 2000 at 28 days.

2.7 SOURCE QUALITY CONTROL

A. The Owner will employ and pay a qualified independent testing agency to perform the following testing for source quality control. Retesting of materials failing to meet specified requirements shall be done at Contractor's expense.

B. Concrete Masonry Unit Tests: For each type of concrete masonry unit indicated, units will be tested for strength, absorption, and moisture content per ASTM C 140.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of unit masonry. Do not proceed with installation until unsatisfactory conditions have been corrected.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of unit masonry.

B. Examine rough-in and built-in construction to verify actual locations of piping connections prior to installation.

3.2 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to the full thickness shown. Build single-wythe walls to the actual thickness of the masonry units, using units of thickness indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections of the Specifications.

C. Leave openings for equipment to be installed before completion of masonry. After installing equipment, complete masonry to match construction immediately adjacent to the opening.

D. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous pattern and to fit adjoining construction. Use full-size units without cutting, where possible. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Mix units for exposed unit masonry from several pallets or cubes as they are placed to produce uniform blend of colors and textures.

3.3 CONSTRUCTION TOLERANCES

A. Variation from Plumb: For vertical lines and surfaces of columns, walls, and arrises, do not exceed 1/4 inch in 10 feet, nor 3/8 inch in 20 feet, nor 1/2 inch in 40 feet or more. For external corners, expansion joints, control joints, and other conspicuous lines, do not exceed 1/4 inch in 20 feet, nor 1/2 inch in 40 feet or more. For vertical alignment of head joints, do not exceed plus or minus 1/4 inch in 10 feet, nor 1/2 inch maximum.

B. Variation from Level: For bed joints and lines of exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines, do not exceed 1/4 inch in 20 feet, nor 1/2 inch in 40 feet or more. For top surface of bearing walls, do not exceed 1/8 inch in 10 feet, nor 1/16 inch within width of a single unit.

C. Variation of Linear Building Line: For position shown in plan and related portion of columns, walls, and partitions, do not exceed 1/2 inch in 20 feet, nor 3/4 inch in 40 feet or more.

D. Variation in Cross-Sectional Dimensions: For columns and thickness of walls, from dimensions shown, do not exceed minus 1/4 inch nor plus 1/2 inch.

E. Variation in Mortar-Joint Thickness: Do not vary from bed-joint thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch. Do not vary bed-joint thickness from bed-joint thickness of adjacent course by more than 1/8 inch. Do not vary from head-joint thickness indicated by more than plus or minus 1/8 inch. Do not vary head-joint thickness from adjacent head-joint thickness by more than 1/8 inch. Do not vary from collar-joint thickness indicated by more than minus 1/4 inch or plus 3/8 inch.

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint widths and for accurate locating of openings, movement-type joints, returns, and offsets. Avoid the use of less-than-half-size units at corners, jambs, and where possible at other locations.

B. Lay walls to comply with specified construction tolerances, with courses accurately spaced and coordinated with other construction.

C. Bond Pattern for Exposed Masonry: Lay exposed masonry in the following bond pattern; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

D. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

E. Stopping and Resuming Work: In each course, rack back 1/2-unit length for one-half running bond or 1/3-unit length for one-third running bond; do not tooth. Clean exposed surfaces of set masonry, wet clay masonry units lightly if required, and remove loose masonry units and mortar prior to laying fresh masonry.

F. Built-in Work: As construction progresses, build-in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.

G. Fill space between hollow metal frames and masonry solidly with mortar, unless otherwise indicated.

1. At exterior frames, insert extruded polystyrene board insulation around perimeter of frame in thickness indicated, but not less than 3/4 inch to act as a thermal break between frame and masonry.

H. Build nonload-bearing interior partitions full height of story to underside of solid floor or roof structure above and as follows:

1. Install compressible filler in joint between top of partition and underside of structure above.

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow concrete masonry units as follows:

1. With full mortar coverage on horizontal and vertical face shells.
2. Bed webs in mortar in all courses.
3. Maintain joint widths indicated, except for minor variations required to maintain bond alignment. If not indicated, lay walls with 3/8-inch joints.

B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

C. Cut joints flush for masonry walls that are to receive plaster or other direct-applied finishes (other than paint), unless otherwise indicated.

3.6 CAVITIES

A. Keep cavities clean of mortar droppings and other materials during construction. Strike joints facing cavities flush.

1. Use wood strips temporarily placed in cavity to collect mortar droppings. As work progresses, remove strips, clean off mortar droppings, and replace in cavity.

3.7 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joints in unit masonry where indicated. Build-in related items as the masonry progresses. Do not form a continuous span through movement joints unless provisions are made to prevent in-plane restraint of wall or partition movement.

B. Form control joints in concrete masonry as follows:

1. Fit bond-breaker strips into hollow contour in ends of block units on one side of control joint. Fill the resultant core with grout and rake joints in exposed faces.

3.8 LINTELS

A. Install steel lintels where indicated.

B. Provide masonry lintels where shown and where openings of more than 24 inches for block size units are shown without structural steel or other supporting lintels.

1. Provide prefabricated or built-in-place masonry lintels. Use specially formed bond beam units with reinforcement bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

C. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

3.9 INSTALLATION OF REINFORCED UNIT MASONRY

A. Temporary Formwork and Shores: Construct formwork and shores to support reinforced masonry elements during construction.

1. Construct formwork to conform to shape, line, and dimensions shown. Make sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

B. Grouting: Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.

1. Do not exceed the following pour heights for coarse grout:

a. For minimum grout space of hollow unit cells of 3 by 4 inches, pour height of 12 feet.

2. Provide cleanout holes at least 3 inches in least dimension for grout pours over 24 inches in height.

a. Provide cleanout holes at each vertical reinforcing bar.

3. Grouted construction shall be in accordance with Article 3.5 of TMS 602/ACI 530.1/ASCE 6.

3.10 FIELD QUALITY CONTROL

A. The Owner will employ and pay a qualified independent testing agency to perform the following testing for field quality control. Retesting of materials failing to meet specified requirements shall be done at Contractor's expense.

B. Testing Frequency: Tests and Evaluations listed in this Article will be performed during construction for each 5000 sq. ft. of wall area or portion thereof.

C. Mortar properties will be tested per property specification of ASTM C 270 and TMS 602/ACI 530.1/ASCE 6..

D. Mortar composition and properties will be evaluated per ASTM C 780

E. Grout will be sampled and tested for compressive strength per ASTM C 1019 and TMS 602/ACI 530.1/ASCE 6 .

F. Prism-Test Method: For each type of wall construction indicated, masonry prisms will be tested per ASTM E 447, Method B, and as follows:

1. A set of five masonry prisms shall be built and tested prior to the start of construction.
2. A set of three prisms shall be built and tested during construction for each 5000 square feet of wall area.

G. Evaluation of Quality-Control Tests: In the absence of other indications of noncompliance with requirements, masonry will be considered satisfactory if results from construction quality-control tests comply with minimum requirements indicated.

3.11 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or if units do not match adjoining units. Install new units to match adjoining units; install in fresh mortar or grout, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point-up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for application of sealants.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears prior to tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
4. Wet wall surfaces with water prior to application of cleaners; remove cleaners promptly by rinsing thoroughly with clear water.

5. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2 applicable to type of stain present on exposed surfaces.

E. Protection: Provide final protection and maintain conditions that ensure unit masonry is without damage and deterioration at time of Substantial Completion.

3.12 MASONRY WASTE DISPOSAL

A. Recycling: Undamaged, excess masonry materials are Contractor's property and shall be removed from the Project site for his use.

B. Excess Masonry Waste: Remove excess, clean masonry waste and legally dispose of off Owner's property.

END OF SECTION

SECTION 04 26 13- ADHERED THIN-BRICK MASONRY VENEER

PART 1 GENERAL

1.01 WORK RESULTS

A. Exterior Adhered Brick Veneer Masonry materials, accessories and other related items necessary to be installed using latex modified Portland cement mortar over a scratch coat of Portland cement plaster (Section 09 24 00 - Portland Cement Plastering) with epoxy grouted joints, and as needed for a complete and proper installation.

B. Exterior Adhered Brick Veneer Masonry materials, accessories and other related items necessary to be installed using latex modified Portland cement mortar over masonry wall with epoxy grouted joints, and as needed for a complete and proper installation.

1.02 SECTION INCLUDES

A. Thin Brick Units.

B. Mortar and Grout.

C. Accessories.

1.03 RELATED REQUIREMENTS

A. Section 07 62 00 - Sheet Metal Flashing and Trim: For exposed sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.

1.04 REFERENCE STANDARDS

A. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar; 2013.1.

B. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.

C. ASTM C1088 - Standard Specification for Thin Veneer Brick Units Made From Clay or Shale; 2014.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2014.

E. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation - Version; 2013.1.

F. TMS 402/ACI 530/ASCE 5, TMS 602/ACI 530.1/ASCE 6 - Building Code Requirements and Specification for Masonry Structures; The Masonry Society; 2011 (including current errata).

1.05 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

B. Sequencing: Ensure that thin veneer system installation in proper order to minimize the possibility of damage during the construction period.

1.06 SUBMITTALS

B. Product Data: Provide data for thin brick units, mortar, grout, and adhesive.

C. Shop Drawings: For the following:
   1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
   2. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

D. Samples: Submit four samples of thin brick units to illustrate color, texture, and extremes of color range.

E. Manufacturer's Certificate: Certify that thin brick units, adhesives, and mortar meet or exceed specified requirements.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual experienced in installing materials similar in material, design, and extent to those indicated for this Project, and whose work has resulted in applications with a record of successful in-service performance, and approved by manufacturer. In addition, the following:
   1. Similar Projects: When requested, Installer shall provide a list of the last three (3) comparable jobs including, name and location, specifying authority / project manager, start / completion dates and value of the painting work.
   2. Staffing: The Installer shall show proof before commencement of work that he will maintain a qualified crew throughout the duration of the work.

B. Sample Panels: Build sample panels to verify selections made under Sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 01 43 39 - Mock-Ups.
   1. Build sample panels for each type of exposed unit masonry construction in sizes approximately 48 by 48 inches (1 200 by 1 200 mm) by full thickness.
   2. Build sample panels facing south.
   3. Clean one-half of exposed faces of panels with masonry cleaner indicated.
   4. Protect approved sample panels from the elements with weather-resistant membrane.
   5. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.
      a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless such deviations are specifically approved by Architect in writing.

C. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.

D. Source Limitations for Thin-Brick: Obtain each color, grade, finish, type, composition, and variety of thin-brick from one source with resources to provide products from the same production run for each contiguous area of consistent quality in appearance and physical properties without delaying the Work.

E. Source Limitations for Setting Materials: Obtain setting ingredients of a uniform quality, including color for exposed masonry, from a single manufacturer for each cementitious component and from one source or producer for each aggregate.

F. Source Limitations for Other Products: Obtain each of the following products specified in this Section from one source and by a single manufacturer for each product.

1.08 MOCK-UP

A.
   1. Prior to other work of this Section, prepare a sample panel of the work of this Section at a location on the site where approved by the Architect.
   2. Make each mock-up panel for each combination of brick pattern, bond pattern, and mortar color.
   3. Show method of bedding, pointing, bond pattern, cleaning, and other aspects of the work of this Section to the quality specified.
   4. Make necessary adjustments in the mock-up panels and secure the Architects approval.
   5. 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.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.10 FIELD CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
   1. Extend cover a minimum of 24 inches (600 mm) down both sides of walls, and hold cover securely in place.

B. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
   1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
   2. Protect sills, ledges, and projections from mortar droppings.
   3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
   4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions.
   1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

1.11 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide for replacing, at no cost to Owner, brick and mortar work exhibiting defects in materials or workmanship within a period as indicated below. Cover damage to work resulting from failure to properly shed water and to resist penetration of moisture. Assist the Owner to properly execute the warranty request forms. Provide the following warranty periods:
   1. Wood Framed Exterior Facades: Provide a ten (10) year period after Date of Substantial Completion.
   2. Concrete and Masonry Substrates: Provide a twenty-five (25) year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: Contract Documents are based on products specified below to establish a standard of quality. Other acceptable manufacturers with products having equivalent

characteristics may be considered, provided deviations are minor and concept expressed in Contract Documents is not changed as judged by Architect.

1. Manufacturer: As specified further in this Section.

B. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide product by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Conditions of the Contract and Division 1 Sections:

1. Manufacturer: As specified further in this Section.

2.02 PERFORMANCE REQUIREMENTS

A. Mortar Bed Installation to meet the following minimum requirements:

1. Compressive Strength: 5,000 psi (34.47 MPa) minimum, when tested in accordance with ANSI A118.4.
2. Bond Strength: 350 psi (2.41 MPa) minimum, when tested in accordance with ANSI A118.4.
3. Water Absorption: 4-percent maximum, when tested in accordance with ANSI A118.4.
4. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

B. Grout Installation to meet the following minimum requirements:

1. Compressive Strength: 3,500 psi (24.13 MPa) minimum, when tested in accordance with ANSI A118.4.
2. Water Absorption: 5-percent maximum, when tested in accordance with ANSI A118.4.
3. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

2.03 THIN BRICK UNITS

A. Basis of Design: H.C. Muddox (Div of Pacific Coast Building Products): www.paccoast.com.

1. Contact: Erin Lynch (Territory Sales Manager); Phone: 916-206-7831, email: erin.lynch@hcmuddox.com.

B. Other Acceptable Manufacturers:

1. Interstate Brick (Div of Pacific Coast Building Products): www.interstatebrick.com.
2. Yankee Hill Brick: www.yankeehillbrick.com.

C. Thin Brick: ASTM C1088, Exterior Grade. Provide all units with straight cut edges and square corners.

1. Type: TBS.
2. Grade: SW.
3. Efflorescence: Provide brick that has been tested in accordance with ASTM C67 and is rated "not effloresced."
4. Size: Standard. 2-1/2" wide by 8" long by 1/2" thick
5. Texture: Wirecut.
6. Thickness: 3/4 inch (12.7 mm).
7. Unit Tolerances:
8. Maximum Unit Weight: 15 psf (718 Pa).
9. Color Blend: Old Sacramento Blend
10. Components:
    a. Stretchers: Provide manufacturer’s standard.
    b. Corners: Provide manufacturer’s 90 degree corner units to match stretcher units.

c. Headers: Provide 90 degree corner units units 2-1/2" wide by 8" long by 1" thick, in standard smooth cut face texture and " Old Sacramento Blend" color, for the all window headers

2.04 ADHESIVE MORTAR SETTING MATERIALS

A. Basis of Design: Laticrete International, Inc; Product "Masonry Veneer Installation System (MVIS)": www. laticrete.com.
   1. Contact: Mark O'Keefe (Technical Sales Representative); Phone: 203-314-9923, email: msokeefe@laticrete.com.

B. Other Acceptable Products:
   1. Custom Building Products; Product "Thin Veneer Installation Systems (TVIS)": www.custombuildingproducts.com.
   2. Mapei Corporation; Product "Thin Brick Installation System": www.mapei.com.
   3. Substitutions: Not permitted.

C. General: Comply with pertinent recommendations contained in the Tile Council of North America (TCNA) "Handbook for Ceramic Tile Installation".

D. Thickset Bed, Modified Dry-Set Portland Cement Mortar: Comply with requirements in ANSI A108.01; pre-blended with Manufacturer's standard water emulsion; for wall applications, provide mortar that complies with requirements for nonsagging mortar.
   1. Application: For use as Brown Coat specified in Section 09 24 00 - Portland Cement Plastering, and in place of Type S or Type N mortar.
   2. Basis of Design: " MVIS Premium Mortar Bed" as manufactured by Laticrete.

E. Epoxy-Based Waterproofing: Epoxy-based 3-component, trowel applied, waterproofing, and vapor barrier membrane complying with ANSI A118
   1. Basis of Design: " Latapoxy Waterproof Flashing Mortar" as manufactured by Laticrete.

F. Medium-Bed, Modified Dry-Set Cement Mortar: Comply with requirements in ANSI A118.4. For wall applications, provide mortar that complies with requirements for nonsagging mortar. Provide product that is approved by manufacturer for application thickness of 1/4 inch (6 mm).
   1. Basis of Design: " MVIS Thin Brick Mortar" as manufactured by Laticrete.

G. Pointing Mortar: Factory prepared, premixed portland cement, graded aggregates, and color-fast pigments complying with ASTM C91/C91M with the addition of water only.
   1. Basis of Design: " MVIS Masonry Pointing Mortar" as manufactured by Laticrete.
   2. Color: Natural Grey.

2.05 FLASHINGS

A. Metal Flashing Materials: Galvanized Steel, as specified in Section 07 62 00.

2.06 ACCESSORIES

A. Air and Water Barrier: Single component, fluid applied, vapor permeable; waterproofing, crack isolation, and air barrier membrane.
   1. Basis of Design: " MVIS Air and Water Barrier" as manufactured by Laticrete.

B. Mildew-Resistant, Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 25, for Use NT.
   1. Basis of Design: " MVIS Silicone Sealant" as manufactured by Laticrete.

2.07 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

1. Basis of Design Product:
   a. EaCo Chem, NMD 80. www.eacochem.com

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
   1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
   2. Verify that substrates are free of substances that impair mortar bond.
   3. Verify that control joints and expansion joints installed under different work are per requirements of thin-brick installation.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A. Adhered Masonry Veneer Standard: Install in accordance with brick manufacturer's instructions to comply with TMS 402/ACI 530/ASCE 5 and authorities having jurisdiction.

B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

C. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges and emulate true thick brick aesthetic.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

F. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30-g/30 sq in (30-g/194 sq cm) per minute when tested according to ASTM C67. Allow units to absorb water so they are damp but not wet at time of laying.

G. Extend brick work into recesses and under or behind fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

3.03 TOLERANCES

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

B. Lines and Levels:
   1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2-inch (12-mm) maximum.
   2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m)), or 1/2-inch (12-mm) maximum.

3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m)), or 1/2-inch (12-mm) maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m)), or 1/2-inch (12-mm) maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m)), or 1/2-inch (12-mm) maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2-inch (12-mm) maximum.

C. Joints:
1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8-inch (3-mm), with a maximum thickness limited to 1/2-inch (12-mm).
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8-inch (3-mm).
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8-inch (9-mm) or minus 1/4-inch (6-mm).
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8-inch (3-mm).
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16-inch (1.5-mm) from one masonry unit to the next.

3.04 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4 inch (100 mm) horizontal face dimensions at corners or jambs.

C. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

3.05 MORTAR BEDDING AND JOINTING

A. Provide 3/8 inch (9 mm) thick minimum setting bed for all thin brick.

B. Stud walls: Apply over scratch coat as specified in Section 09 24 00 - Portland Cement Plastering. Allow scratch coat to cure a minimum 48 hours before applying setting bed.

C. Lay masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

3.06 EXPANSION JOINTS

A. General: Install expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span expansion joints without provision to allow for in-plane wall or partition movement.

B. Form expansion joints as follows:

1. Build flanges of metal expansion strips into masonry. Lap each joint 4 inches (100 mm) in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.
2. Build flanges of factory-fabricated, expansion-joint units into masonry.
3. Build in compressible joint fillers where indicated.
4. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch (10 mm) for installation of sealant and backer rod specified in Section 07 92 00 - Joint Sealants.

C. Provide horizontal, pressure-relieving joints by either leaving an airspace or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 07 92 00 - Joint Sealants, but not less than 3/8 inch (10 mm).
1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.07 LINTELS

A. Install steel lintels where indicated.

B. Provide minimum bearing of 8 inches (200 mm) at each jamb unless otherwise indicated.

3.08 FLASHING, WEEP HOLES, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.

B. Install flashing as follows unless otherwise indicated:
1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape.
2. Extend flashing through veneer, across airspace behind veneer, and up face of sheathing at least 8-inches (200-mm); with upper edge tucked under air barrier, lapping at least 4-inches (100-mm).
3. At lintels and shelf angles, extend flashing a minimum of 6-inches (150-mm) into masonry at each end. At heads and sills, extend flashing 6-inches (150-mm) at ends and turn up not less than 2-inches (50-mm) to form end dams.

C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

D. Install weep holes in veneers in head joints of first course of masonry immediately above embedded flashing.
1. Use specified weep/vent products to form weep holes.
2. Space weep holes 24-inches (600-mm) on center, unless otherwise indicated.
3. Cover cavity side of weep holes with plastic insect screening at cavities insulated with loose-fill insulation.
4. Trim wicking material flush with outside face of wall after mortar has set.

E. Place cavity drainage material in airspace behind veneers to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

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

3.09 CUTTING BRICK MASONRY UNITS

A. When possible, use full units of the proper size in stead of cut units.

B. When required cut units should be placed in the center of the wall and should be greater than 1/2 the stretcher length.

C. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

D. Cut and fit for pipes and conduit. Coordinate with other sections of work to provide correct size, shape, and location.

3.10 FIELD QUALITY CONTROL

A. Architect to observe appearance of installed units after installation and cleaning. Masonry surfaces should be viewed a distance of 15 feet (4-1/2 meters) to assess the masonry and to insure that imperfections do not detract from overall appearance.

3.11 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
   1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
   2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
   3. Protect adjacent nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
   4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
   5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

3.12 MASONRY WASTE DISPOSAL

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

B. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

C. Remove construction debris from Project in accordance with Section 01 74 19 - Construction Waste Management and Disposal.

3.13 SCHEDULE

A. Exterior Wall Installations, Wood or Metal Studs or Furring; Natural Stone:
   1. Tile Installation W231/W241: Thin-set mortar over waterproof membrane on portland cement plaster scratch coat; TCNA W231/W241.
      a. Application: Building stud wall with scratch coat of portland cement plaster.
      b. Thin-Set Mortar: Medium-bed, latex-portland cement mortar.
      c. Pointing Mortar: Polymer-modified sanded grout.

B. Exterior Wall Installations, Masonry or Concrete; Natural Stone:
   1. Tile Installation W202E: Thin-set mortar over waterproof membrane; TCNA W202E.
      a. Thin-Set Mortar: Medium-bed, latex-portland cement mortar.
      b. Pointing Mortar: Polymer-modified sanded grout.

END OF SECTION

SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 GENERAL

1. RELATED DOCUMENTS

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

2. SUMMARY

   a) Section Includes:

      Framing with dimension lumber.
      Framing with engineered wood products.
      Rooftop equipment bases and support curbs.
      Wood sleepers.

   b) Related Requirements:

      Section 06 10 63 "Exterior Rough Carpentry" for elevated decks and other exterior construction made of wood.
      Section 061600 "Sheathing."
      Section 31 31 16 "Termite Control" for site application of borate treatment to wood framing.

3. DEFINITIONS

   a) Exposed Framing: Framing not concealed by other construction.

   b) Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) or greater but less than 5 inches nominal (114 mm actual) in least dimension.

   c) Timber: Lumber of 5 inches nominal (114 mm actual) or greater in least dimension.

   d) Lumber grading agencies, and the abbreviations used to reference them, include the following:

      NeLMA: Northeastern Lumber Manufacturers' Association.
      NLGA: National Lumber Grades Authority.
      RIS: Redwood Inspection Service.
      SPIB: The Southern Pine Inspection Bureau.
      WCLIB: West Coast Lumber Inspection Bureau.
      WWPA: Western Wood Products Association.

4. ACTION SUBMITTALS

a) Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.

b) Fastener Patterns: Full-size templates for fasteners in exposed framing.

5. INFORMATIONAL SUBMITTALS

a) Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

b) Evaluation Reports: For the following, from ICC-ES:

Wood-preservative-treated wood.
Engineered wood products.
Shear panels.
Powder-actuated fasteners.
Expansion anchors.
Metal framing anchors.

6. QUALITY ASSURANCE

a) Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

7. DELIVERY, STORAGE, AND HANDLING

a) Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 PRODUCTS

1. WOOD PRODUCTS, GENERAL

a) Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

Factory mark each piece of lumber with grade stamp of grading agency.
Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
Provide dressed lumber, S4S, unless otherwise indicated.

b) Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal (38-mm actual) thickness or less, 19 percent for more than 2-inch nominal (38-mm actual) thickness unless otherwise indicated.

c) Engineered Wood Products: Provide engineered wood products acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.

Allowable Design Stresses: Provide engineered wood products with allowable design stresses, as published by manufacturer that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2. WOOD-PRESERVATIVE-TREATED LUMBER

a) Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 See Evaluations for information about treatment chemicals.

Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

b) Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

c) Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

For exposed lumber indicated to receive a stained or natural finish, Retain first option and delete list that follows if all rough carpentry must be treated with wood preservative.

d) Application: Treat items indicated on Drawings, and the following:

Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
Wood sills, sleepers, blocking, and similar concealed members in contact with masonry or concrete.
Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
Wood framing members that are less than 18 inches (460 mm) above the ground in crawlspaces or unexcavated areas.
Wood floor plates that are installed over concrete slabs-on-grade.

3. DIMENSION LUMBER FRAMING

a) Load-Bearing Partitions: No. 2 grade.

Application: Exterior walls
Species:
Douglas fir-larch; WCLIB or WWPA.

b) Joists, Rafters, and Other Framing Not Listed Above: No. 1 grade.

Species:
Douglas fir-larch; WCLIB or WWPA.

4. FASTENERS

a) General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

b) Nails, Brads, and Staples: ASTM F 1667.

c) Power-Driven Fasteners: NES NER-272.

d) Wood Screws: ASME B18.6.1.

e) Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).

f) Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

g) Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).

PART 3 EXECUTION

1. INSTALLATION, GENERAL

a) Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

b) Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

c) Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.

d) Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels Shear Wall Panels: Install shear wall panels to comply with manufacturer's written instructions.

e) Metal Framing Anchors: Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

f) Install sill sealer gasket to form continuous seal between sill plates and foundation walls.

g) Do not splice structural members between supports unless otherwise indicated.

h) Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches (406 mm) o.c.

i) Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:

Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches (2438 mm) o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches (2438 mm) o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal- (38-mm actual-) thickness.

Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. (9.3 sq. m) and to solidly fill space below partitions.
Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet (6 m) o.c.

j) Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

k) Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

Use inorganic boron for items that are continuously protected from liquid water.
Use copper naphthenate for items not continuously protected from liquid water.

l) Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

NES NER-272 for power-driven fasteners.
Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.

m) Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

END OF SECTION

SECTION 06 16 00 - SHEATHING

PART 1 GENERAL

1. RELATED DOCUMENTS

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

2. SUMMARY

   a) Section Includes:

      1. Wall sheathing.
      2. Roof sheathing.

   b) Related Requirements:

      Section 06 10 00 "Rough Carpentry"
      Section 07 25 00 "Weather Barriers" for water-resistive barrier applied over wall sheathing.

3. INFORMATIONAL SUBMITTALS

   a) Evaluation Reports: For following products, from ICC-ES:

      Preservative-treated plywood.
      Fire-retardant-treated plywood.

4. QUALITY ASSURANCE

   a) Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

5. DELIVERY, STORAGE, AND HANDLING

   a) Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 PRODUCTS

1. WOOD PANEL PRODUCTS

a) Emissions: Products shall meet the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

b) Certified Wood: For the following wood products, provide materials produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship":

Plywood.
Oriented strand board.

c) Plywood: Either DOC PS 1 or DOC PS 2 unless otherwise indicated.

d) Oriented Strand Board: DOC PS 2.

e) Thickness: As needed to comply with requirements specified, but not less than thickness indicated.

f) Factory mark panels to indicate compliance with applicable standard.

2. PRESERVATIVE-TREATED PLYWOOD

a) Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2See Evaluations for information about treatment chemicals.

Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

b) Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

3. WALL SHEATHING

a) Oriented-Strand-Board Wall Sheathing: Exposure 1, Structural I sheathing.

Span Rating: Not less than 32/16.
Nominal Thickness: Not less than 15/32 inch (11.9 mm).

4. ROOF SHEATHING

a) Oriented-Strand-Board Roof Sheathing: Exposure 1, Structural I sheathing.

Span Rating: Not less than 48/24.
Nominal Thickness: Not less than 15/32 inch (11.9 mm).

5. FASTENERS

a) General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

b) Nails, Brads, and Staples: ASTM F 1667.

c) Power-Driven Fasteners: NES NER-272.

d) Wood Screws: ASME B18.6.1.

e) Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

For wall and roof sheathing panels, provide screws with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

f) Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

For steel framing less than 0.0329 inch (0.835 mm) thick, use screws that comply with ASTM C 1002.
For steel framing from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick, use screws that comply with ASTM C 954.

g) Screws for Fastening Oriented-Strand-Board-Surfaced, Polyisocyanurate-Foam Sheathing to Metal Roof Deck: Steel drill screws, in type and length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117. Provide washers or plates if recommended by sheathing manufacturer.

6. SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

7. MISCELLANEOUS MATERIALS

a) Adhesives for Field Gluing Panels to Framing: Formulation complying with APA AFG-01 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

Adhesives shall have a VOC content of 50g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
Adhesives shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile

Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

PART 3 EXECUTION

1. INSTALLATION, GENERAL

a) Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

b) Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

c) Securely attach to substrate by fastening as indicated, complying with the following:

NES NER-272 for power-driven fasteners.
Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."
Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's "International Residential Code for One- and Two-Family Dwellings."

d) Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.

e) Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

f) Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

g) Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

2. WOOD STRUCTURAL PANEL INSTALLATION

a) General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

b) Fastening Methods: Fasten panels as indicated below:

Wall and Roof Sheathing:

Nail to wood framing.
Screw to cold-formed metal framing.
Space panels 1/8 inch (3 mm) apart at edges and ends.

END OF SECTION

SECTION 06 18 00 - STRUCTURAL GLUED-LAMINATED TIMBER

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. New roof framing members below mechanical units / equipment.

1.3 DEFINITIONS

A. Structural Glued-Laminated (Glulam) Timber: An engineered, stress-rated timber product assembled from selected and prepared wood laminations bonded together with adhesives with the grain of the laminations approximately parallel longitudinally.

1.4 SUBMITTALS

A. Product Data: For glulam timber and accessories. Include installation instructions and data on lumber, adhesives, fabrication, treatment, and protection.

B. Shop Drawings: Show layout of structural glulam timber system and full dimensions of each member. Indicate species and laminating combination, adhesive type, and other variables in required Work.

C. Certificates of Conformance: Issued by a qualified inspection and testing agency indicating that glu-lam timbers comply with requirements of AITC A190.1 & 2001 CBC Sections 2303.1.3.

D. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed structural glulam timber construction similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Manufacturer Qualifications: Provide factory-glued structural units produced by an AITC-licensed firm.

1. Factory mark each piece of structural glulam timber with AITC Quality Mark. Place mark on surfaces that will not be exposed in completed Work.

C. Quality Standard: Comply with AITC A190.1, "Structural Glued Laminated Timber" and 2001 CBC Sections 2303.1.3.

1.6 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with provisions of AITC 111, "Recommended Practice for Protection of Structural Glued Laminated Timber during Transit, Storage, and Erection."

B. Individually wrap members with plastic-coated paper covering, with water-resistant seams, before shipping or exposing to outdoor conditions.

PART 2 PRODUCTS

2.1 STRUCTURAL GLULAM TIMBER FRAMING

A. Species and Grades for Beams, Purlins, and Arches: Provide glulam members of the following species that comply with AITC 117--MANUFACTURING for the following combination symbol:

1. Species and Combination Symbol for simple spans: Douglas fir, 24FV4.
2. Species and Combination Symbol for cantilevered spans: Douglas fir, 24FV8.

B. Appearance Grade: Provide “Architectural” appearance grade members complying with AITC 110, where exposed.

C. Adhesive: Wet-use type complying with ASTM D 2559.

D. Connectors, Anchors, and Accessories: Fabricate from structural-steel shapes, plates, and bars complying with ASTM A 572, Grade 50.

1. Provide bolts, 3/4 inch, unless otherwise indicated, complying with ASTM A 307, Grade A; nuts complying with ASTM A 563; and, where indicated, flat washers.
2. Finish each assembly and fastener with rust-inhibitive primer, 2-mil dry film thickness.

2.2 FABRICATION

A. Camber: Fabricate horizontal and inclined members, units of less than 1:1 slope, with either circular or parabolic camber as indicated.

B. Moisture content at time of fabrication and reinforcing installation shall not exceed eleven percent (11%).

PART 3 EXECUTION

3.1 INSTALLATION

A. General: Erect structural glulam timber framing true and plumb, with uniform, close-fitting joints. Provide temporary bracing to maintain lines and levels until permanent supporting members are in place.

1. Use padded slings and protect corners with wood blocking.

B. Fit structural glulam timber framing by cutting and restoring exposed surfaces to match specified surfacing. Predrill for fasteners and assembly of units.

1. Use connectors as templates for drilling bolt holes.

C. Install steel connectors, anchors, and accessories as indicated.

3.2 ADJUSTING AND CLEANING

A. Repair damaged surfaces and finishes after completing erection. Replace damaged structural glulam timber if repairs are not approved by Architect.

3.3 PROTECTION

A. Do not remove wrappings on individually wrapped members until they no longer serve a useful purpose, including protection from weather, soiling, and damage from work of other trades.

END OF SECTION

SECTION 07 21 00 - BUILDING INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A This Section includes the following:

1. Exterior cavity wall thermal insulation.
2. Interior cavity wall insulation.
3. Underside of roof deck thermal insulation. (Above suspended ceiling tiles)

B Related Sections include the following:

1. Division 9 Sections "Gypsum Board Assemblies" for installation in metal-framed assemblies of insulation specified by reference to this Section.

1.03 SUBMITTALS

A Product Data: For each type of product indicated.

1.04 QUALITY ASSURANCE

A Source Limitations: Obtain each type of building insulation through one source.

B Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1. Surface-Burning Characteristics: ASTM E 84.

1.05 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.01 MANUFACTURERS

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

1. Glass-Fiber Insulation:

    a) CertainTeed Corporation.

    b) Johns Manville Corporation.

    c) Owens Corning.

2.02 INSULATING MATERIALS

A Basis of Design Product: Products are based on the named manufacturer or an approved comparable product and manufacturer.

1. Exterior cavity wall thermal insulation: Owens Corning, Thermal Batt Insulation, kraft faced, R-19.

2. Interior cavity wall insulation: Owens Corning, Sound Attentuation Batt Insulation, unfaced.(R-13)

3. Thermal insulation at underside of roof deck: Owens Corning, Thermal Batt Insulation, foil faced, Refer to Mechanical drawings for R-value.

4. Vinyl faced draped insulation for Pre-manufactured metal buildings. Color – White. See Section 13125.

2.03 INSULATION FASTENERS

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

1. Adhesively Attached, Spindle-Type Anchors:

    a) AGM Industries, Inc.; Series T TACTOO Insul-Hangers.

    b) Gemco; Spindle Type.

2. Anchor Adhesives: -

    a) AGM Industries, Inc.; TACTOO Adhesive.

    b) Gemco; Tuff Bond Hanger Adhesive.

B Insulation-Retaining Washers: Install at bottom of roof decking, self-locking washers formed from 0.016-inch- (0.41-mm-) thick galvanized steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches (38 mm) square or in diameter.

C Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.

PART 3 - EXECUTION

3.01 EXAMINATION

A Examine substrates and conditions, with Installer present, for compliance with requirements for Sections in which substrates and related work are specified and other conditions affecting performance.

B Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

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

3.03 INSTALLATION, GENERAL

A Comply with insulation manufacturer's written instructions applicable to products and application indicated.

B Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice and snow.

C Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D Water-Piping Coordination: If water piping is located on inside of insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.

E Apply single layer of insulation to produce thickness indicated, unless multiple layers are otherwise shown or required to make up total thickness.

3.04 INSTALLATION OF GENERAL BUILDING INSULATION

A Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B Set vapor-retarder-faced units with vapor retarder to warm side of construction, unless otherwise indicated. Do not obstruct ventilation spaces, except for firestopping.

1. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.

C Install insulation on roof decking substrates by adhesively attached, spindle-type insulation anchors as follows:

1. Fasten insulation anchors to substrates with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application indicated.

2. After adhesive has dried, install insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation below indicated thickness.

3.05 PROTECTION

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

END OF SECTION

SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A This Section includes the following sheet metal flashing and trim:

1. Manufactured reglets.
2. Formed roof drainage system.
3. Formed roof flashing and trim.
4. Formed wall flashing and trim.
5. Formed equipment support flashing.

B Related Sections include the following:

1. Division 7 Section "Asphalt Roof Shingles” for installing sheet metal flashing and trim integral with roofing system.
2. Division 7 Section "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
3. Division 7 Section "Joint Sealants" for field-applied sheet metal flashing and trim sealants.

1.03 PERFORMANCE REQUIREMENTS

A General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.

B Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

C Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

1.04 SUBMITTALS

A Shop Drawings: Show layouts of sheet metal flashing and trim, including plans and elevations. Distinguish between shop- and field-assembled work. Include the following:

1. Identify material, thickness, weight, and finish for each item and location in Project.

2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.

3. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.

4. Details of expansion-joint covers, including showing direction of expansion and contraction.

1.05 QUALITY ASSURANCE

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

1.06 DELIVERY, STORAGE, AND HANDLING

A Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.

B Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.

C Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1.07 COORDINATION

A Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leak-proof, secure, and noncorrosive installation.

PART 2 - PRODUCTS

2.01 SHEET METALS

A Aluminum Sheet: ASTM B 209 (ASTM B 209M), Alloy 3003, 3004, 3105, or 5005, Temper suitable for forming and structural performance required, but not less than H14, finished as follows:

1. Mill Finish: Standard one-side bright.

B Zinc-Tin Alloy-Coated Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, dead-soft, fully annealed stainless-steel sheet, coated on both sides with a zinc-tin alloy (50 percent zinc, 50 percent tin).

1. Product: Subject to compliance with requirements, provide "TCS II" by Follansbee Steel.

C Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.

D Lead Sheet: ASTM B 749, Type L51121, copper-bearing lead sheet.

2.02 UNDERLAYMENT MATERIALS

A Polyethylene Sheet: 6-mil- (0.15-mm-) thick polyethylene sheet complying with ASTM D 4397.

B Felts: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, non-perforated.

C Slip Sheet: Rosin-sized paper, minimum 3 lb/100 sq. ft. (0.16 kg/sq. m).

2.03 MISCELLANEOUS MATERIALS

A General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.

B Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.

1. Exposed Fasteners: Heads matching color of sheet metal by means of plastic caps or factory-applied coating.

2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex washer head.

3. Blind Fasteners: High-strength aluminum or stainless-steel rivets.

4. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

C Solder for Zinc-Tin Alloy-Coated Stainless Steel: ASTM B 32, 100 percent tin.

D Solder for Lead: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.

E Burning Rod for Lead: Same composition as lead sheet.

F Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.

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

H Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

I Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

J Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.04 MANUFACTURED SHEET METAL FLASHING AND TRIM

A Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory- mitered and -welded corners and junctions.

1. Material: Galvanized steel, 0.0217 inch (0.55 mm) thick.

2. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.

3. Flexible Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.

4. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.

2.05 FABRICATION, GENERAL

A General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.

B Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.

C Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.

1. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.

2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.

D Sealed Joints: Form non expansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.

E Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with elastomeric sealant concealed within joints.

F Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.

G Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" for application but not less than thickness of metal being secured.

2.06 ROOF DRAINAGE SHEET METAL FABRICATIONS

A Parapet Scuppers: Fabricate scuppers of dimensions required with closure flange trim to exterior, 4-inch- (100-mm-) wide wall flanges to interior, and base extending 4 inches (100 mm) beyond cant or tapered strip into field of roof. Fasten gravel guard angles to base of scupper.

1. Fabricate parapet scuppers from the following material:

a) Galvanized Steel: 0.0276 inch (0.7 mm) thick.

2.07 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A Copings: Fabricate in minimum 96-inch- (2400-mm-) long, but not exceeding 10-foot- (3-m-) long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, seal, and solder or weld watertight.

1. Fabricate copings from the following material:

a) Galvanized Steel: 0.0396 inch (1.0 mm.

B Base Flashing: Fabricate from the following material:

1. Galvanized Steel: 0.0276 inch (0.7 mm).

C Counterflashing: Fabricate from the following material:

1. Galvanized Steel: 0.0217 inch (0.55 mm) thick.

D Flashing Receivers: Fabricate from the following material:

1. Galvanized Steel: 0.0217 inch (0.55 mm) thick.

E Roof-Penetration Flashing: Fabricate from the following material:

1. Lead: 4.0 lb/sq. ft. (1.6 mm thick), hard tempered.

2. Galvanized Steel: 0.0276 inch (0.7 mm) thick.

F Roof-Drain Flashing: Fabricate from the following material:

1. Lead: 4.0 lb/sq. ft. (1.6 mm thick), hard tempered.

2.08 WALL SHEET METAL FABRICATIONS

A Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch- (2400-mm-) long, but not exceeding 12 foot (3.6 m) long, sections, under copings, at shelf angles, and where indicated. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches (150 mm) beyond each side of wall openings. Form with 2-inch- (50-mm-) high end dams. Fabricate from the following material:

1. Zinc-Tin Alloy-Coated Stainless Steel: 0.015 inch (0.4 mm) thick.

2.09 MISCELLANEOUS SHEET METAL FABRICATIONS

A Equipment Support Flashing: Fabricate from the following material:

1. Galvanized Steel: 0.0276 inch (0.7 mm) thick.

2.10 FINISHES

A Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.01 EXAMINATION

A Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.

1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Torch cutting of sheet metal flashing and trim is not permitted.

B Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.

1. Coat side of uncoated aluminum and lead sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.

2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene underlayment.

3. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.

C Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.

D Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and elastomeric sealant.

E Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

1. Space cleats not more than 12 inches (300 mm) apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.

F Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with elastomeric sealant concealed within joints.

G Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws.

1. Galvanized or Pre-painted, Metallic-Coated Steel: Use stainless-steel fasteners.

2. Aluminum: Use aluminum or stainless-steel fasteners.

H Seal joints with elastomeric sealant as required for watertight construction.

1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).

2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

I Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches (38 mm) except where pre-tinned surface would show in finished Work.

1. Do not solder aluminum sheet.

2. Pre-tinning is not required for zinc-tin alloy-coated stainless steel and lead.

3. Do not use open-flame torches for soldering. Heat surfaces to receive solder and flow solder into joints. Fill joints completely. Completely remove flux and spatter from exposed surfaces.

J Aluminum Flashing: Rivet or weld joints in uncoated aluminum where necessary for strength.

3.03 ROOF DRAINAGE SYSTEM INSTALLATION

A General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.

B Parapet Scuppers: Install scuppers where indicated through parapet. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.

1. Anchor scupper closure trim flange to exterior wall and seal or solder to scupper.

3.04 ROOF FLASHING INSTALLATION

A General: Install sheet metal roof flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight.

B Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches (100 mm) over base flashing. Install stainless-steel draw band and tighten.

C Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches (100 mm) over base flashing. Lap counterflashing joints a minimum of 4 inches (100 mm) and bed with elastomeric sealant.

1. Secure in a waterproof manner by means of snap-in installation and sealant or lead wedges and sealant.

D Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:

1. Turn lead flashing down inside vent piping, being careful not to block vent piping with flashing.

2. Seal with elastomeric sealant and clamp flashing to pipes penetrating roof except for lead flashing on vent piping.

3.05 WALL FLASHING INSTALLATION

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

3.06 MISCELLANEOUS FLASHING INSTALLATION

A Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

3.07 CLEANING AND PROTECTION

A Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B Clean and neutralize flux materials. Clean off excess solder and sealants.

C Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

D Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A This Section includes joint sealants for the applications indicated in the Joint-Sealant Schedule at the end of Part 3.

B Related Sections include the following:

1. Division 8 Section "Glazing" for glazing sealants.
2. Division 9 Section "Gypsum Board Assemblies" for sealing perimeter joints of gypsum board partitions to reduce sound transmission.
3. Division 9 Section "Ceramic Tile" for sealing tile joints.

1.03 PERFORMANCE REQUIREMENTS

A Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

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

1.04 SUBMITTALS

A Product Data: For each joint-sealant product indicated.

B Qualification Data: For Installer.

1.05 QUALITY ASSURANCE

A Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.

B Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.06 PROJECT CONDITIONS

A Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.

2. When joint substrates are wet.

3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.

4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.07 WARRANTY

A Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

B Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Ten years from date of Substantial Completion.

C Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:

1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.

2. Disintegration of joint substrates from natural causes exceeding design specifications.

3. Mechanical damage caused by individuals, tools, or other outside agents.

4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A Basis of Design Product: The design is based upon Dow Corning products or comparable manufacturer and product.

2.02 MATERIALS, GENERAL

A Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and

application, as demonstrated by sealant manufacturer, based on testing and field experience.

2.03 ELASTOMERIC JOINT SEALANTS

A Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

2.04 ACOUSTICAL JOINT SEALANTS

A Acoustical Sealant for Concealed Joints: Manufacturer's standard, nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.

1. Products:

a) Pecora Corporation; BA-98.

b) Tremco; Tremco Acoustical Sealant.

2.05 JOINT-SEALANT BACKING

A General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

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

2.06 MISCELLANEOUS MATERIALS

A Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.01 EXAMINATION

A Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a) Concrete.

    b) Unglazed surfaces of ceramic tile.

3. Remove laitance and form-release agents from concrete.

4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

    a) Metal.

    b) Glass.

    c) Prefinished architectural panels,

B Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.03 INSTALLATION OF JOINT SEALANTS

A General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C Acoustical Sealant Application Standard: Comply with recommendations in ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.

D Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.

2. Do not stretch, twist, puncture, or tear sealant backings.

3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

E Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.

2. Completely fill recesses in each joint configuration.

3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.

2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.

3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

3.04 CLEANING

A Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.05 PROTECTION

A Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.06 JOINT-SEALANT SCHEDULE

A Joint-Sealant Application JS-#1: Exterior vertical and horizontal nontraffic construction joints in cast-in-place concrete.

1. Joint Sealant: Dow Corning, #756
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

B Joint-Sealant Application JS-2#: Exterior butt joints between metal panels.

1. Joint Sealant: Dow Corning, #791 or 795.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

C Joint-Sealant Application JS-3#: Exterior vertical joints between different materials.

1. Joint Sealant: Dow Corning, #756 or 790.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

D Joint-Sealant Application JS-4#: Exterior perimeter joints between adjacent walls and frames of doors windows and louvers.

1. Joint Sealant: Dow Corning, #756.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

E Joint-Sealant Application JS-#5: Interior perimeter joints of exterior openings.

1. Joint Sealant: Latex sealant.
2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

F Joint-Sealant Application JS-#6: Interior joints between plumbing fixtures and adjoining walls, floors, and counters.

1. Joint Sealant: Latex sealant.
2. Joint-Sealant Color: White.

G Joint-Sealant Application JS-#7: Perimeter joints between interior wall surfaces and frames of interior doors windows and elevator entrances.

1. Joint Sealant: Dow Corning, #786.

2. Joint-Sealant Color: As selected by Architect from manufacturer's full range .

END OF SECTION

SECTION 08 11 13 – HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A This Section includes the following:
1. Steel doors.
2. Steel door frames.

B Related Sections include the following:
1. Division 8 Section "Door Hardware ".
2. Division 9 Section "Gypsum Board Assemblies".
3. Division 9 Section "Painting".

1.03 DEFINITIONS

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

1.04 SUBMITTALS

A Product Data: For each type of door and frame indicated, include door designation, type, level and model, material description, core description, construction details, label compliance, sound and fire-resistance ratings, and finishes.

B Shop Drawings: Show the following:
1. Elevations of each door design.
2. Details of doors including vertical and horizontal edge details.
3. Frame details for each frame type including dimensioned profiles.
4. Details and locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, accessories, joints, and connections.

C Door Schedule: Use same reference designations indicated on Drawings in preparing schedule for doors and frames.

1.05 QUALITY ASSURANCE

A Steel Door and Frame Standard: Comply with ANSI A 250.8, unless more stringent requirements are indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish of factory-finished doors and frames.

B Inspect doors and frames on delivery for damage, and notify shipper and supplier if damage is found. Minor damages may be repaired provided refinished items match new work and are acceptable to Architect. Remove and replace damaged items that cannot be repaired as directed.

C Store doors and frames at building site under cover. Place units on minimum 4-inch- (100-mm-) high wood blocking. Avoid using non-vented plastic or canvas shelters that could create a humidity chamber. If door packaging becomes wet, remove cartons immediately. Provide minimum 1/4-inch (6-mm) spaces between stacked doors to permit air circulation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Steel Doors and Frames: Ceco Door Products; a United Dominion Company.

2.02 MATERIALS

A Hot-Rolled Steel Sheets: ASTM A 569/A 569M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

B Cold-Rolled Steel Sheets: ASTM A 366/A 366M, Commercial Steel (CS), or ASTM A 620/A 620M, Drawing Steel (DS), Type B; stretcher-leveled standard of flatness.

C Metallic-Coated Steel Sheets: ASTM A 653/A 653M, Commercial Steel (CS), Type B, with an A40 (ZF120) zinc-iron-alloy (galvannealed) coating; stretcher-leveled standard of flatness.

D Electrolytic Zinc-Coated Steel Sheet: ASTM A 591/A 591M, Commercial Steel (CS), Class B coating; mill phosphatized; suitable for unexposed applications; stretcher-leveled standard of flatness where used for face sheets.

2.03 DOORS

A General: Provide doors of sizes, thicknesses, and designs indicated.

B Exterior Doors: Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:
1. Level 2 and Physical Performance Level B (Heavy Duty), Model 1 (Full Flush).

2.04 FRAMES

A General: Provide steel frames for doors, transoms, sidelights, borrowed lights, and other openings that comply with ANSI A250.8 and with details indicated for type and profile. Conceal fastenings, unless otherwise indicated.ZFG

B Frames of 0.053-inch- (1.3-mm-) thick steel sheet for:
1. Door openings wider than 48 inches (1220 mm).
2. Wood doors, unless otherwise indicated.

C Door Silencers: Except on weather-stripped frames, fabricate stops to receive three silencers on strike jambs of single-door frames and two silencers on heads of double-door frames.

D Supports and Anchors: Fabricated from not less than 0.042-inch- (1.0-mm-) thick, electrolytic zinc-coated or metallic-coated steel sheet.

E Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where zinc-coated items are to be built into exterior walls, comply with ASTM A 153/A 153M, Class C or D as applicable.

2.05 FABRICATION

A General: Fabricate steel door and frame units to comply with ANSI A250.8 and to be rigid, neat in appearance, and free from defects including warp and buckle. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site.

B Exterior Door Construction: For exterior locations and elsewhere as indicated, fabricate doors, panels, and frames from metallic-coated steel sheet. Close top and bottom edges of doors flush as an integral part of door construction or by addition of 0.053-inch- (1.3-mm-) thick, metallic-coated steel channels with channel webs placed even with top and bottom edges.

C Core Construction: Manufacturer's standard core construction that produces a door complying with SDI standards.

D Clearances for Non-Fire-Rated Doors: Not more than 1/8 inch (3.2 mm) at jambs and heads, except not more than 1/4 inch (6.4 mm) between pairs of doors. Not more than 3/4 inch (19 mm) at bottom.

E Single-Acting, Door-Edge Profile: Square edge.

F Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

G Fabricate concealed stiffeners, reinforcement, edge channels, louvers, and moldings from either cold- or hot-rolled steel sheet.

H Exposed Fasteners: Unless otherwise indicated, provide countersunk flat or oval heads for exposed screws and bolts.

I Hardware Preparation: Prepare doors and frames to receive mortised and concealed hardware according to final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements in ANSI A250.6 and ANSI A115 Series specifications for door and frame preparation for hardware.
1. For concealed overhead door closers, provide space, cutouts, reinforcement, and provisions for fastening in top rail of doors or head of frames, as applicable.

J Frame Construction: Fabricate frames to shape shown.
1. For exterior applications, fabricate frames with mitered or coped and continuously welded corners.
2. Provide welded frames with temporary spreader bars.

K Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at Project site.

L Locate hardware as indicated on Shop Drawings or, if not indicated, according to ANSI A250.8.

2.06 FINISHES

A Prime Finish: Manufacturer's standard, factory-applied coat of rust-inhibiting primer complying with ANSI A250.10 for acceptance criteria.

PART 3 - EXECUTION

3.01 INSTALLATION

A General: Install steel doors, frames, and accessories according to Shop Drawings, manufacturer's data, and as specified.

B Placing Frames: Comply with provisions in SDI 105, unless otherwise indicated. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.

1. Except for frames located in existing walls or partitions, place frames before construction of enclosing walls and ceilings.
2. In existing concrete or masonry construction, provide at least three completed opening anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Set frames and secure to adjacent construction with bolts and masonry anchorage devices.
3. In metal-stud partitions, provide at least three wall anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Attach wall anchors to studs with screws.
4. For openings 90 inches (2286 mm) or more in height, install an additional anchor at hinge and strike jambs.

C Door Installation: Comply with ANSI A250.8. Fit hollow-metal doors accurately in frames, within clearances specified in ANSI A250.8. Shim as necessary to comply with SDI 122 and ANSI/DHI A115.1G.

1. Smoke-Control Doors: Install to comply with NFPA 105.

3.02 ADJUSTING AND CLEANING

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

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

END OF SECTION

SECTION 08 14 16 – FLUSH WOOD DOORS

PART 1 - GENERAL

1.01 SUMMARY

A. SECTION INCLUDES

1. Work under this section comprises of furnishing solid core doors with wood veneer faces, light frames, factory fitting and machining and factory finishing for fire labeled and non-labeled flush wood doors.

B. RELATED DOCUMENTS

1. Related documents, drawings and general provisions of contract, including General and Supplementary Conditions and Division 1 specification sections apply to this section.

C. RELATED SECTIONS

1. 08110 – Metal Doors and Frames

1.02 REFERENCES

A. STANDARDS

1. NFPA-80 – Fire Doors and Windows
2. NFPA-105 – Recommend Practice for Installation of Smoke Controlled Door Assemblies
3. WDMA I.S. 1A – Wood Door Manufacturer's Association, Flush Wood Door Performance Standards
4. UL10C - Standard for Positive Pressure Fire Tests of Door Assemblies

B. CODES

1. NFPA-101 – Life Safety Code
2. IBC 2003 – International Building Code

3. ANSI-A117.1 – Accessible and Usable Buildings and Facilities.

4. ADA – Americans with Disabilities Act

1.03 SUBMITTALS

A. GENERAL REQUIREMENTS

1. Submit copies of the hollow metal door and frame shop drawings in accordance with Division 1, General Requirements.

B. PRODUCT DATA

1. Submit shop drawings showing fabrication and installation of flush wood doors. Include details of door elevations, details of construction, location and installation requirements of door hardware.

C. SHOP DRAWINGS

1. Provide a schedule of doors and frames using same reference numbers for details and door openings as those on the contract documents. Shop drawings should include the following information:

a. Door core material.

b. Mortises and reinforcements.

c. Glazed and louvered openings and material.

d. Mounting locations of standard hardware.

D. SAMPLES

1. Upon request submit the following samples:

a. Corner sections of doors approximately 8” x 10” with door faces and edgings representing the typical range of color and grain for each species of veneer and solid lumber required.

b. Finish sample with same materials proposed for site-finished doors or manufacturer's prefinished samples for factory-finished doors.

c. Frames for light openings, 6" long, for each material, type, and finish required.

1.04 QUALITY ASSURANCE

A. SUBSTITUTIONS

1. All substitution requests must be submitted within the procedures and time frame as outlined in Division 1, General Requirements. Approval of products is at the discretion of the architect and his consultant.

B. MANUFACTURER QUALIFICATIONS

1. Manufacturer shall be a member in good standing of the Wood Door Manufacturer's Association (WDMA).

2. Obtain wood doors from a single manufacturer to ensure uniformity in quality of appearance and construction. All material supplied for this project to conform to WDMA I.S. 1A-97 for premium grade wood doors.

C. FIRE RATED DOORS

1. Project requires door assemblies and components that are compliant with positive pressure and S-label requirements. Specifications must be cross-referenced and coordinated with hardware and other door manufacturers to ensure that total opening engineering is compatible with UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and UBC 7-2, Fire Tests of Door Assemblies.

   a. Certification(s) of compliance shall be made available upon request by the Authority Having Jurisdiction.

2. A physical label to be permanently affixed to the fire door at an authorized facility. Furthermore, all 45, 60, and 90 minute label fire doors are to have manufacturer's standard laminated stiles for improved screw holding and split resistance capability.

   a. At stairwell enclosures, provide doors that have a temperature-rise rating of 450-degree F maximum in 30 minutes of fire exposure.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect doors during transit, storage, and handling to prevent damage, soiling, and deterioration. Doors are to be shipped from manufacturer in individual polybags, and shall be inspected immediately upon arrival at jobsite for any damage of defects.

B. Identify each door with individual opening numbers that correlate with designation system used on shop drawings and contract drawings for door, frames and hardware. Use only temporary, removable, or concealed markings.

C. Do not deliver or install doors until building is enclosed, wet-work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy level in storage and installation areas.

1.06 WARRANTY

A. Warranties shall be in addition to, and not a limitation of other rights the owner may have under the contract documents.

B. Submit written warranty on manufacturer's standard form signed by the manufacturer agreeing to replace or repair defective doors which have:

1. Delamination in any degree.

2. Warp or twist of 1/4" or more in any 3' x 6" x 7' plane of door face.

3. Telegraphing of stile, rail or core through face to cause surface variation in excess of 1/100" in any 3" spans.

C. Contractor shall replace or refinish doors where contractor's work contributed to rejection or voiding of manufacturer's warranty.

D. Solid core interior doors shall be warranted for the life of their installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, provide flush wood doors by one of the manufacturers as listed.

2.02 DOORS

A. GENERAL REQUIREMENTS

1. Doors shall have premium grade A faces with manufacturer's standard five (5) ply construction; minimum 1/8" thick.

2. Faces shall be minimum 1/50" at 12% moisture content thick after finish sanding.

   a. Veneer Cut: Plain Sliced

   b. Face Assembly: Book Match, Running Match

   c. Stain Color: As selected by Manufacturer's Full Range.

   d. Veneer Species: Select White Birch

3. Doors shall have minimum 1" stiles on the hinge stile and 13/16" minimum on the lock stile; both stiles faces shall match the door veneer. Top and bottom rails shall be a minimum 13/16"; rails shall be mill option hardwood or structural composite lumber (SCL).

4. All fire rated doors shall be supplied to meet UL10C positive pressure standards for category "A" doors. All required intumescent seals shall be concealed into the edge of the door; frame applied intumescent seals are not acceptable.

5. All fire rated doors shall be supplied to meet UL10C positive pressure standards for category "B" doors. All required intumescent seals shall be supplied as specified in section 08 71 00 – Door Hardware.

B. NON RATED AND 20 MINUTE DOORS

1. Supply particleboard core complying with WDMA I.S. 1A and ANSI-A208.1, Grade 1-LD, bonded to the door faces, stiles and rails using a Type I adhesive. Components are to be assembled to meet or exceed 20 minute fire door specifications for UL10C fire test requirements.

   a. Algoma: Super Novodor / FD 1/3

   b. Eggers: PC5 / PC5-20

   c. Graham: GPD PC5 / GPD PC5-20

   d. Marshfield: DPC-1 / DFP-20

   e. VT Industries: 5502

2. Supply engineered core complying with WDMA I.S. 1A, bonded to door faces, stiles and rails using a Type I adhesive. Components are to be assembled to meet or exceed 20 minute fire door specifications for UL10c fire test requirements. Door shall meet or exceed WDMA I.S. 1A Extra Heavy Duty performance standards.

a. Algoma: FGFW

b. Eggers: SCL5 / SCL5-20

c. Graham: GPD EC5 / GPD EC5-20

d. Marshfield: DCL-1 / DCL-20

e. VT Industries: 5508

3. Provide LSL Timberstrand blocking at particleboard-core doors as follows to preclude the use of thru-bolts:

a. Provide 5” top-rail blocking, at doors indicated to have closers.

b. Provide 5” mid-rail blocking, at doors indicated to have exit devices.

C. FIRE RATED DOORS OVER 20 MINUTES

1. Supply fire resistive composite mineral core construction to provide the fire rating indicated, boned to door faces, stiles and rails using a Type I adhesive. Components are to be assembled to meet or exceed fire door specifications for UL10C fire test requirements.

a. Algoma: FD

b. Eggers: FGP

c. Graham: GPD FD5

d. Marshfield: DFM

e. VT Industries: 5545/5511

2. For mineral-core doors, provide composite blocking with improved screw holding capability approved for use in doors of fire ratings indicated as necessary to eliminate need for through-bolting hardware and as follows:

a. Provide 5” top-rail blocking.

b. Provide 4 1/2” x 10” lock blocks.

c. Provide 5” mid-rail blocking, at doors indicated to have exit devices.

3. At hinge stiles, provide manufacturer's standard laminated-edge construction with improved screw-holding capability and split resistance and with outer stile matching face veneer.

2.03 FACTORY FINISHING

A. Prefinish all wood doors at the factory with a clear sealant; no stain is required.

B. Prefinish all wood doors per WDMA I.S. 1A, Section G-15, Factory Finishing for Premium Grade factory finish systems.

C. Finish doors using three (3) coats of water-clear 100% solids, modified acrylic urethane, cured immediately with ultra-violet light.

D. Factory seal doors on all six (6) sides using manufacturer's standard meeting these applications.

2.04 FIELD FINISHING

A. Field Finish wood doors in accordance with Division 9, Painting.

2.05 LIGHT FRAMES

A. Provide wood frames for light openings as follows:

1. Wood Species: Same species as door faces.

2. Profile: Manufacturer's standard shape.

3. Frames for Openings in Fire Doors: Wood frames and metal glazing clips approved for use in 20-minute fire-rated wood-core doors.

B. Provide manufacturer's standard wood veneered beads for fire doors that are approved for use in doors of fire rating indicated. Include concealed metal glazing clips where required for opening size and fire rating indicated.

C. Provide manufacturer's standard metal light frame formed of 18-gauge, cold-rolled steel sheet, factory primed and approved for use in doors of fire rating indicated.

2.06 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels, unless otherwise indicated:

1. Comply with clearance requirements of referenced quality standard for fitting. Comply with requirements of NFPA 80 for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.

1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.

2. Premachine metal astragals and formed-steel edges for hardware for pairs of fire-rated doors.

C. Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of door(s) required.

1. Trim openings with moldings of material and profile indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine installed door frames before hanging doors.

1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with plumb jambs and level heads.

2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. For hardware installation, see Division 8 Section "Door Hardware."

B. Install wood doors to comply with manufacturer's written instructions, referenced quality standard and as indicated.

1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.

C. Align factory fitted doors in frames for uniform clearance at each edge.

3.03 ADJUSTING AND PROTECTING

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

B. Refinish or replace doors damaged during installation.

C. Protect doors as recommended by door manufacturer to ensure that wood doors are without damage or deterioration at the time of Substantial Completion.

END OF SECTION

SECTION 085313 - VINYL WINDOWS

PART 2 GENERAL

1. RELATED DOCUMENTS

   a) Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
      Rough Carpentry 06 10 00
      Portland Cement Plaster 09 24 00
      Gypsum Board Assemblies 09 29 00

2. SUMMARY

   a) Section includes vinyl-framed windows.

3. ACTION SUBMITTALS

   a) Product Data: For each type of product.

      Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes for vinyl windows.

   b) Shop Drawings: For vinyl windows.

      Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.

   c) Samples: For each exposed product and for each color specified, 2 by 4 inches (50 by 100 mm) size.

   d) Samples: For vinyl windows and components required, prepared on Samples of size indicated below:

      Exposed Finishes: 2 by 4 inches (50 by 100 mm)
      Exposed Hardware: Full-size units.

   e) Product Schedule: For vinyl windows. Use same designations indicated on Drawings.

4. INFORMATIONAL SUBMITTALS

   a) Qualification Data: For manufacturer and Installer.

   b) Product Test Reports: For each type of vinyl window, for tests performed by a qualified testing agency.

c) Field quality-control reports.

d) Sample Warranties: For manufacturer's warranties.

5. QUALITY ASSURANCE

a) Manufacturer Qualifications: A manufacturer capable of fabricating vinyl windows that meet or exceed performance requirements indicated and of documenting this performance by test reports and calculations.

b) Installer Qualifications: An installer acceptable to vinyl window manufacturer for installation of units required for this Project.

6. WARRANTY

a) Manufacturer's Warranty: Manufacturer agrees to repair or replace vinyl windows that fail in materials or workmanship within specified warranty period.

Failures include, but are not limited to, the following:

Failure to meet performance requirements.
Structural failures including excessive deflection, water leakage, and air infiltration.
Faulty operation of movable sash and hardware.
Deterioration of materials and finishes beyond normal weathering.
Failure of insulating glass.

Warranty Period:

Window: Lifetime, from date of Substantial Completion.
Glazing Units: Lifetimefrom date of Substantial Completion.

PART 3 PRODUCTS

1. MANUFACTURERS

a) Source Limitations: Obtain vinyl windows from single source from single manufacturer.

2. WINDOW PERFORMANCE REQUIREMENTS

a) Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

Window Certification: WDMA certified with label attached to each window.

b) Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:

Minimum Performance Class: Commercial

c) Thermal Transmittance: NFRC 100 maximum whole-window U-factor, Refer to Energy Compliance Sheets.

d) Solar Heat-Gain Coefficient (SHGC): Refer to Energy Compliance Sheets.

3. VINYL WINDOWS

a) Manufactured by Milgard or Approved Equal

b) Operating Types: Provide the following operating types in locations indicated on Drawings:

Horizontal Sliding.
Double hung.
Fixed.

c) Frames and Sashes: Impact-resistant, UV-stabilized PVC complying with AAMA/WDMA/CSA 101/I.S.2/A440.

Finish: Integral color, white
Gypsum Board Returns: Provide at interior face of frame.

d) Glass: Clear tempered glass, ASTM C 1036, Type 1, Class 1, q3.

Kind: Fully tempered at all locations

e) Insulating-Glass Units: ASTM E 2190. Glass: ASTM C 1036, Type 1, Class 1, q3. Manufacturer's standard factory-glazing system that produces weathertight seal

Float Glass: Fully tempered
Inner Ply: Clear.
Outer Ply: Gray (at exterior windows. Clear at interior windows)
Low-E Coating: Pyrolytic on second surface

f) Hardware, General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock windows, and sized to accommodate sash weight and dimensions.

Exposed Hardware Color and Finish, As selected by Architect from manufacturer's full range

g) Hung Window Hardware:

Counterbalancing Mechanism: Complying with AAMA 902, concealed, of size and capacity to hold sash stationary at any open position.
Locks and Latches: Allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only.
Tilt Hardware: Releasing tilt latch allows sash to pivot about horizontal axis to facilitate cleaning exterior surfaces from the interior.

h) Horizontal-Sliding Window Hardware:

Sill Cap/Track: Rigid PVC or other weather-resistant plastic track with manufacturer's standard integral color of dimensions and profile indicated; designed to comply with performance requirements indicated and to drain to the exterior.
Locks and Latches: Allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only.
Roller Assemblies: Low-friction design.

i) Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.

j) Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.

Exposed Fasteners: Do not use exposed fasteners to greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

4. INSECT SCREENS

a) General: Fabricate insect screens to integrate with window frame. Provide screen for each operable exterior sash. Screen wickets are not permitted.

Type and Location: Full, outside for double-hung. Full, outside for sliding sashes.

b) Aluminum Frames: Manufacturer's standard aluminum alloy complying with SMA 1004 or SMA 1201. Fabricate frames with mitered or coped joints or corner extrusions, concealed fasteners, and removable PVC spline/anchor concealing edge of frame.

Tubular Framing Sections and Cross Braces: Roll formed from aluminum sheet.
Finish for Exterior Screens: Baked-on organic coating in color selected by Architect from manufacturer's full range

c) Glass-Fiber Mesh Fabric: 18-by-14 (1.1-by-1.4-mm) mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration. Comply with ASTM D 3656/D 3656M.

Mesh Color: selected by Architect from Manufacturer's full range

d) Aluminum Wire Fabric: 18-by-16 (1.1-by-1.3-mm) mesh of 0.011-inch- (0.28-mm-) diameter, coated aluminum wire.

Wire-Fabric Finish: Charcoal gray

5. FABRICATION

a) Fabricate vinyl windows in sizes indicated. Include a complete system for installing and anchoring windows.

b) Glaze vinyl windows in the factory.

c) Weather strip each operable sash to provide weathertight installation.

d) Mullions: Provide mullions and cover plates, compatible with window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections. Provide mullions and cover plates capable of withstanding design wind loads of window units. Provide manufacturer's standard finish to match window units.

e) Hardware: Mount hardware through double walls of vinyl extrusions or provide corrosion-resistant reinforcement.

f) Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation. Allow for scribing, trimming, and fitting at Project site.

PART 4 EXECUTION

1. EXAMINATION

a) Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

b) Verify rough opening dimensions, levelness of sill plate, and operational clearances.

c) Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.

d) Proceed with installation only after unsatisfactory conditions have been corrected.

2. INSTALLATION

a) Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E 2112.

b) Install windows level, plumb, square, true to line, without distortion, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.

3. FIELD QUALITY CONTROL

a) Testing Agency: Engage a qualified testing agency to perform tests and inspections.

Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.

b) Testing Services: Testing and inspecting of installed windows shall take place as follows:

Testing Methodology: Testing of windows for air infiltration and water resistance shall be performed according to AAMA 502.
Air-Infiltration Testing:

Test Pressure: That required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance class indicated.
Allowable Air-Leakage Rate: 1.5times the applicable AAMA/WDMA/CSA 101/I.S.2/A440 rate for product type and performance class rounded down to one decimal place.

Water-Resistance Testing:

Test Pressure: Two-thirds times test pressure required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance grade indicated.
Allowable Water Infiltration: No water penetration.

Testing Extent: Three windows of each type as selected by Architect and a qualified independent testing and inspecting agency. Windows shall be tested after perimeter sealants have cured.
Test Reports: Prepared according to AAMA 502.

c) Windows will be considered defective if they do not pass tests and inspections.

d) Prepare test and inspection reports.

4. ADJUSTING, CLEANING, AND PROTECTION

a) Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.

b) Clean exposed surfaces immediately after installing windows. Remove excess sealants, glazing materials, dirt, and other substances.

Keep protective films and coverings in place until final cleaning.

c) Remove and replace sashes if glass has been broken, chipped, cracked, abraded, or damaged during construction period.

d) Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written instructions.

END OF SECTION

SECTION 08 71 00 - FINISH HARDWARE

PART 1 GENERAL

1.01 SUMMARY:

A. Section Includes: Finish hardware except as otherwise specified or specifically omitted herein.

B. Specific Omissions: Hardware for the following is specified or indicated elsewhere.
1. Windows
2. Cabinets of all kinds, including open wall shelving and locks.
3. Toilet accessories of all kinds including grab bars.
4. Folding partitions, except cylinders where detailed.

1.02 SUBSTITUTIONS & SUBMITTALS:

A. Requests for substitutions must be made in writing 10 days prior to bid date to allow architect to issue an addendum. If proposing a substitute, submit that product data attached to one showing specified item and indicate savings to be made. No other substitutions will be allowed.

1. Items listed with no substitute manufactures have been requested by Owner to match existing.

B. SUBMITTALS: Submit six copies of schedule at earliest possible date prior to delivery of hardware. Organize schedule into "Hardware Sets" with an index of doors and heading, indicating complete designations of every item required for each door or opening. Include the following information:
1. Type, style, function, size, quantity and finish of each hardware item.
2. Name, part number and manufacturer of each item.
3. Fastenings and other pertinent information.
4. Location of hardware set cross referenced to indications on drawings both on floor plans and in door schedule.
5. Explanation of all abbreviations, symbols, and codes contained in schedule.
6. Mounting locations for hardware.
7. Door and frame sizes and materials.
8. Submit manufacture's technical data and installation instructions for the electronic hardware.
9. Catalog cuts.

C. Templates: Where required, furnish hardware templates to each fabricator of doors, frames and other work to be factory-prepared for the installation of hardware.

1.03 QUALITY ASSURANCE:

A. Qualifications:

1. Obtain each kind of hardware (latch and locksets, exit devices, hinges, and closers) from only one manufacturer, although several may be indicated as offering products complying with requirements.

2. Hardware supplier shall be a direct factory contract supplier who has in his employment a certified architectural hardware consultant (AHC) who is available at all reasonable times during the course of the Work, and for project hardware consultation to the Owner, Architect, and Contractor.

B. Schedule Designations: Except as otherwise indicated, the use of one manufacturer's numeric designation system in schedules does not imply that another manufacturer's products will not be acceptable, unless they are not equal in design, size, weight, finish function, or other quality of significance. See 1.02 A for substitutions.

C. Exit Doors: Openable at all times from the inside without the use of a key or any special knowledge or effort.

D. Fire-rated openings: Provide hardware for fire-rated openings in compliance with NFPA Standard No. 80. This requirement takes precedence over other requirements for such hardware. Provide only such hardware which has been tested and listed by UL for the type and size of door required, and complies with the requirements of the door and the door frame labels. Latching hardware, door closers, ball bearing hinges, and seals are required whether or not listed in the Hardware schedule.
1. Where panic exit devices are required on fire-rated doors, provide supplementary marking on door UL label on exit device indicating "Fire Exit Hardware."

1.04 DELIVERY, STORAGE, AND HANDLING:

A. Acceptance at the Site: Individually package each unit of finish hardware complete with proper fastening and appurtenances, clearly marked on the outside to indicate contents and specific locations in the Work.

B. Deliver packaged hardware items at the times and to the locations (shop or field) for installation, as directed by the Contractor.

1.05 PROJECT CONDITIONS:

A. Coordination: Coordinate hardware with other work. Furnish hardware items of proper design for use on doors and frames of the thickness, profile, swing security and similar requirements indicated, as necessary for the proper installation and function, regardless of omissions or conflicts in the information on the Contract Documents.

B. Upon request, check the Shop Drawings for doors and entrances to confirm that adequate provisions will be made for the proper installation of hardware.

1.06 WARRANTY:

A. Provide guarantee from hardware supplier as follows:
1. Closers: Ten years: except electronic closers: Two years.

2. Exit Devices & Locksets: Three years
3. All other Hardware: Two years.

PART 2 PRODUCTS

2.01 MANUFACTURERS:

A. See Drawings for Approved manufacturers.

B. Furnish all items of hardware required to complete the work in accordance with specifications and plans.

C. Carefully inspect Project for the extent of the finish hardware required to complete the Work. Where there is a conflict between these Specification and the existing hardware furnish finish hardware to specification.

2.02 MATERIALS:

A. Exterior: Mortise type Locks and Latches shall be heavy-duty with hinged, anti-friction, 3/4 inch throw latchbolt with anti-friction piece made of self lubricating stainless steel. Functions and design as indicated on the hardware groups. Deadbolt functions shall be 1 inch projection made of hardened stainless steel. both deadbolt and latchbolt are to extend into the case a minimum of 3/8 inch when fully extended. Furnish locksets and latchsets with sufficient curved strike lip to protect door trim. Provide locksets with 7-pin interchangeable core cylinders. All mortise cylinders shall have a concealed internal set screw for securing the cylinder to the lockset. The internal set screw will be accessible only by removing the core from the cylinder body. Locksets and latchsets to have self-aligning, thru-bolted trim. Auxiliary deadlatch to be made of one piece stainless steel, permanently lubricated. Lever handles must be of forged or cast brass, bronze or stainless steel construction. Levers which contain a hollow cavity are not acceptable. Spindle to be such that if forced it will twist first, then break, thus preventing forced entry. Levers to be operated with a roller bearing spindle hub mechanism.

Interior: All locksets and latchsets shall be extra-heavy-duty lever cylindrical with Best 7-pin interchangeable core. Lockset and Cores to be of the same manufacturer to maintain complete lockset warranty. Locks to have solid shank with no opening for access to keyed lever keeper. Keyed Lever to be protected by means of a break-away mechanism to prevent forced entry, when excessive torque is applied, a replaceable part will shear. Lock chassis must be through-bolted (outside of the lock chassis prep) to prevent rotation of chassis after installation. Lock manufacturer shall provide a three-year warranty, in writing, to the Owner, along with three copies of the lock service manual. Strikes shall be 16 gauge curved brass, bronze or stainless steel with a 1” deep box construction, and have sufficient length to clear trim and protect clothing.

1. Grade 1 Cylindrical Locks shall have minimum 9/16 throw. All deadbolts shall have 1-inch minimum throw.
2. Comply with requirements of local security ordinances.
3. Lock Series and Design: Best 35H7 15H Trim and 93K7 15D Trim.
   Cylinders: Best 7-Pin

B. Hinges: Outswinging exterior doors shall have non removable pin hinges. All hinge open widths shall be minimum, but of sufficient size to permit door to swing 180. Furnish hinges with five knuckles and flush bearing.
   1. Furnish 3 hinges per leaf to 7 foot 6 inch height. Add one for each additional 30 inches in height or fraction thereof.
   2. Provide hinges as listed in schedule.

C. Exit Devices: Furnish all sets at wood doors with sex bolts unless otherwise specified. Lever handle trim shall match locksets. All touch bar type devices shall have deadlocking latchbolt, stainless steel touchpads or vinyl covered pads and be non-handed. The unlatching force shall not exceed 15 pounds when applied in the direction of exit travel.

D. Surface Door Closers: Full rack and pinion type with removable non-ferrous cover. Provide sex bolts at all wood doors. Place closers inside building, stairs, and rooms. Closers shall be non-handed, non-sized and adjustable.
   1. Provide multi-size 1 through 6 at all doors rated or not.
   2. Flush transom offset brackets shall be used where parallel arm closers are listed for doors with fixed panels over.
   3. Drop brackets are required at narrow head rails.
   4. Set exterior doors closers to have 8.5 lbs maximum pressure to open, interior non-rated at 5 lbs, rated openings at 12 lbs.

E. Kickplates: Provide with four beveled edges, 10 inches high by width less 2 inches on single doors and 1 inch on pairs of doors. Furnish screws to match finish.

F. Seals: All seals shall be finished to match adjacent frame color. Seals shall be furnished as listed in schedule. Material shall be UL listed for labeled openings.

G. Screws: All exposed screws shall be Phillips head.

H. Silencers: Furnish silencers on all interior frames, 3 for single doors, 2 for pairs. Omit where any type of seals occur.

2.03 FINISH:

A. Generally to be BHMA 626 Satin Chrome.
   1. Protection Plates, Push, Pulls shall be BHMA 630.

B. Spray door closers to match other hardware, unless otherwise noted.

C. Aluminum items shall be finished to match predominant adjacent material. Seals to coordinate with frame color.

2.04 KEYING REQUIREMENTS:

A. Provide construction cores and keys during the construction period. Construction control and operating keys and core shall not be part of the Owner's permanent keying system or furnished on the same keyway (or key section) as the Owner's permanent keying system. Permanent cores and keys (prepared according to the accepted keying schedule) will be furnished to the Owner (by the local Best factory representative) prior to occupancy.

B. All cylinders shall be Best 7-pin, interchangeable core.

C. Permanent keys and cores shall be stamped with the applicable key mark for identification. These visual key control marks or codes will not include the actual key cuts. Permanent keys will also be stamped "Do Not Duplicate."

D. Locksets and cylinders will be keyed, master keyed, and grand master keyed into the Owner's system. Keying will be performed by Owner.

F. The Owner, or the Owner's agent, will install permanent cores and return the construction cores to the Best Access Systems Factory Representative. All Construction cores and keys remain the property of Best Access Systems.

G. Keying schedule: Submit three copies of separate detailed schedule indicating clearly how the Owner's final instructions on keying of locks has been fulfilled.

PART 3 EXECUTION

3.01 HARDWARE LOCATIONS:

A. Hinges:
1. Bottom Hinge: 10 inches from door bottom to bottom of hinge.
2. Top Hinge: 5 inches from door top to top of hinge.
3. Center Hinge: Center between top and bottom hinge.
4. Extra Hinge: 6 inches from bottom of top hinge to top of extra hinge.

B. Lock: 38 inches from finished floor to center of lever or knob.

C. Push Bar: 44 inches from bottom of door to center of bar.

D. Push Plate: 44 inches from bottom of door to center of plate.

E. Pull Plate: 42 inches from bottom of door to center of pull.

F. Exit Device: 39-13/16 inches from finished floor to center of pad.

G. Deadlock Strike: 44 inches from floor, centered.

3.02 INSTALLATION:

A. Install each hardware item per manufacturer's instructions and recommendations. Do not install surface mounted items until finishes have been completed on the substrate. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

B. Installation shall conform to local governing agency security ordinance.

3.03 ADJUSTING:

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.

B. Inspection: Hardware supplier shall inspect all hardware furnished within 10 days of contractor's request and include with his guarantee a statement that this has

been accomplished. Inspector or Contractor shall sign off the hardware as being complete and correctly installed and adjusted. Further corrections of defective material shall be the responsibility of his representative.

3.04 SCHEDULE OF FINISH HARDWARE:

A. Schedule of Finish Hardware on the Drawings indicates which Hardware Set is used with door.

END OF SECTION

SECTION 08 80 00 – GLAZING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
   1. Windows and sidelites.
   2. Doors.
   3. Glazed entrances.
   4. Storefront framing.
   5. Curtain wall

B. Related Sections include the following:
   1. Division 8 Section "Aluminum-Framed Entrances and Storefronts."

1.03 DEFINITIONS

1.04 PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.05 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Samples: For the following products, in the form of 12-inch- (300-mm-) square Samples for glass.
   1. Each color of tinted float glass.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association Glazier Certification Program as Level 2 (Senior Glaziers) or Level 3 (Master Glaziers).

B. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for Project and whose work has resulted in construction with a record of successful in-service performance.

C. Fire-Rated Window Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 257.

D. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201 and ANSI Z97.1.
   1. Subject to compliance with requirements, permanently mark safety glass with certification label of Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.

E. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
   1. GANA Publications: GANA'S "Glazing Manual" and "Laminated Glass Design Guide."
   2. SIGMA Publications: SIGMA TM-3000, "Vertical Glazing Guidelines," and SIGMA TB-3001, "Sloped Glazing Guidelines."

F. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following inspecting and testing agency:
   1. Insulating Glass Certification Council.
   2. Associated Laboratories, Inc.
   3. National Accreditation and Management Institute.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. For insulating-glass units that will be exposed to substantial altitude changes, comply with insulating-glass manufacturer's written recommendations for venting and sealing to avoid hermetic seal ruptures.

1.08 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1.09 WARRANTY

A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Manufacturer's Special Warranty on Coated-Glass Products: Written warranty, made out to Owner and signed by coated-glass manufacturer agreeing to furnish replacements for those coated-glass units that deteriorate within specified warranty period indicated below.

1. Warranty Period: 10 years from date of Substantial Completion.

C. Manufacturer's Special Warranty on Insulating Glass: Written warranty, made out to Owner and signed by insulating-glass manufacturer agreeing to furnish replacements for insulating-glass units that deteriorate within specified warranty period indicated below.
1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PRODUCTS AND MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products indicated in schedules at the end of Part 3.

2.02 INSULATING GLASS

A. Insulating-Glass Units: Preassembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 774 for Class CBA units and with requirements specified in this Article and in the Insulating-Glass Schedule at the end of Part 3.
1. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in "Performance Requirements" Article. Provide Kind FT (fully tempered) where safety glass is indicated.

B. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated in the Insulating-Glass Schedule at the end of Part 3 are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.

C. Sealing System: Dual seal, with primary and secondary sealants as follows:
1. Manufacturer's standard sealants.

D. Spacer Specifications: Manufacturer's standard spacer material and construction.

E. Spacer Specifications: Manufacturer's standard spacer material and construction complying with the following requirements:
1. Aluminum with mill or clear-anodized finish.
2. Corner Construction: Manufacturer's standard corner construction.

2.03 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:
   1. Neoprene, ASTM C 864.
   2. EPDM, ASTM C 864.
   3. Silicone, ASTM C 1115.
   4. Thermoplastic polyolefin rubber, ASTM C 1115.
   5. Any material indicated above.

B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned gaskets of material indicated below; complying with ASTM C 509, Type II, black; and of profile and hardness required to maintain watertight seal:
   1. Neoprene.
   2. EPDM.
   3. Silicone.
   4. Thermoplastic polyolefin rubber.
   5. Any material indicated above.

2.04 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

2.05 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing standard, to comply with system performance requirements.

B. Grind smooth and polish exposed glass edges.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine framing glazing, with Installer present, for compliance with the following:
   1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
   2. Presence and functioning of weep system.
   3. Minimum required face or edge clearances.
   4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.03 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where the length plus width is larger than 50 inches (1270 mm) as follows:
   1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
   2. Provide 1/8-inch (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.04 GASKET GLAZING (DRY)

A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with stretch allowance during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Install gaskets so they protrude past face of glazing stops.

3.05 PROTECTION AND CLEANING

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for build-up of dirt, scum, alkaline deposits, or stains; remove as recommended by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer.

3.06 MONOLITHIC FLOAT-GLASS SCHEDULE

A. Uncoated Clear Float Glass: Where glass as designated below is indicated, provide Type I (transparent glass, flat), Class 1 (clear) glass lites complying with the following:
   1. Uncoated Clear Fully Tempered Float Glass: Kind FT (fully tempered).

B. Coated Tinted Float Glass: Where glass as designated below is indicated, provide Class 2 (tinted, heat-absorbing, and light-reducing) glass lites complying with the following:
   1. Tint Color: “Solar Grey" by PPG.
   2. Coated Tinted Fully Tempered Float Glass: Kind FT (fully tempered).

C. Low-E Coated Float Glass: Where glass as designated below is indicated, provide Class 2 (heat-absorbing, and light-reducing) glass lites complying with the following:
   1. Low-E coated Fully Tempered Float Glass: Kind FT (fully tempered).

END OF SECTION

SECTION 09 24 00 - PORTLAND CEMENT PLASTER

PART 1 - GENERAL

1.01 SUMMARY

A. This Section describes the requirements for materials, fabrications and installation of exterior cement plaster and associated accessory items

B. Related Sections of Work:

1. Division 5 Section "Cold-Formed Metal Framing" for structural, load-bearing (transverse and axial) steel studs and joists that support lath and portland cement plaster.

2. Division 6 Section "Rough Carpentry" for wood framing and furring, sheathing, and water-resistant barriers included in portland cement plaster assemblies.

3. Division 7 Section "Building Insulation" for thermal insulations and vapor retarders included in portland cement plaster assemblies.

4. Division 7 Section "Joint Sealants" for sealants installed with exterior portland cement plaster (stucco).

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

C. Definitions of Plaster Thickness: Minimum overall thickness measured from face of support (stud, furring, masonry, concrete) to face of finish coat. Thickness includes lath.

1.02 REFERENCES

A. The General Conditions, Supplementary Conditions, and applicable portions of Division 1 apply to the work of this Section as if printed herein.

1.03 SUBMITTALS

A. Manufacturer's literature describing products.

B. Samples:

1. Cement Plaster Finish: Submit 12”x12” square plaster panel for color and texture at the jobsite. Subsequent work shall match approved sample.

1.04 QUALITY ASSURANCE

A. Standards:

1. Federal Specifications (FS).
2. American Society for Testing and Materials (ASTM).
   a. "Standard Specification for Portland Cement and Portland Cement-Lime Plastering, Exterior (Stucco) and Interior" (ASTM C-926).
   b. Standard Specification for Portland Cement (ASTM C150).
   c. Metal Lath (ASTM C847).
   d. Sand (ASTM C144).
   e. Lime (ASTM C206).
3. American National Standards Institute:
   a. "Standard Specification for Portland Cement and Portland Cement-Lime Plastering" (ANSI A42.2).

b. "Standard Specification for Lathing and Furring for Portland Cement and Portland Cement-Lime Plastering, Exterior (Stucco) and Interior" (ANSI A42.3-1971).

4. Portland Cement Association (PCA).
   a. Plasterer's Manual.
5. Underwriter's Laboratories Inc. "Building Materials List", latest edition (UL).

B. Design Criteria:
1. Lath and related accessories shall provide proper, secure base, and reinforcement for plaster systems.
2. Plaster systems shall provide suitable base for finishes.
3. Exposed finish surfaces shall be true, even, without waves, cracks, or imperfections. Cracks, blisters, pits, or discoloration will not be acceptable.

C. Allowable Tolerances: Surface tolerance shall be limited to 3/16" in 8' as measured in any direction from a 10 foot straight edge.

1.05 DELIVERY, STORAGE AND HANDLING

A. Conform to the requirements specified in Section 01600. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use.

1.06 PROJECT CONDITIONS

A. Environmental Requirements:
1. Do not subject newly applied plaster to hot, dry winds.
2. Do not install exterior plaster when prevailing temperature is less than 40 degrees F.

B. Protection:
1. Protect adjacent surfaces from plastering operations.
2. Coordinate details of work with that of other trades whose work supports, adjoins, or fastens to lath and plaster work.

PART 2 - PRODUCTS

2.01 LATH MATERIALS

A. Metal Lath: Finish shall be per ML/SFA standards:
1. Type SFB, Self-Furring Base with Backing:
Woven Wire Fabric with Backing: Galvanized copper bearing cold-drawn steel wire; 1-1/2 inch mesh of minimum 17 gauge wire with 18 gauge longitudinal wire woven into netting on six-inch centers and attached to 18 gauge wire laminated between high wet-strength suction paper and backing paper, with continuous 1/4" deep furring crimp six inches on center: backing paper shall be waterproof and comply with FS UU-B-790A, Type 1, Grade B, Style 1a, with flame spread rating of 25 or less.
2. Expanded-Metal Lath: ASTM C 847 with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized zinc coating.

B. Building Paper (Felt): Conform to the requirements of FS UU-B-790, Grade B or D, or ANSI A42.3, with flame spread rating of 25 or less.

C. Attachments and Fastenings:
1. Tie Wire: FS QQ-W-461h, Finish 5, Class 1 soft temper; minimum 18 gauge.
2. Screws: Galvanized, self-drilling, and self tapping, as recommended by approved applicator.
3. Nails and Staples: Type, use and application shall conform with Title 24, Part 2, CAC and/or UBC as applicable.
4. Clips: Form from galvanized steel sheets or wire as per approved manufacturer's design.

D. Typical Accessories:
1. Corner Beads: Fabricated from minimum No. 26 gauge steel, galvanized.

2. Cornerite: Per ANSI A42.3. Expanded metal lath of minimum 1.75 lbs. per square yard; galvanized, or painted with rust inhibitive paint after fabrication.

3. Casing Beads: ANSI A42.3; fabricated from minimum No. 24 gauge galvanized steel with short or expanded flange; of various shapes.

4. Strip Reinforcement: Fabricated from minimum 1.75 lbs. per square yard expanded metal lath; galvanized minimum 6 inches wide.

5. Control Joints: Fabricated from 0.0221 inch thick zinc alloy or galvanized minimum 26 gauge steel with perforated or expanded flanges shaped to permit complete embedment in the plaster, and to provide means for accurate alignment and secure attachment to the underlying surface.

6. Ventilating Expansion Screeds: ANSI A42.3 Fabricated from 0.0221 inch thick zinc alloy or galvanized minimum 26 gauge steel.
7. Drip Screed: ANSI A42.3 Fabricated from 0.0221 inch thick zinc alloy or galvanized minimum 26 gauge steel; with or without weep holes.
8. Aluminum reveal screeds. Miter corners where applicable.

2.02 PLASTER MATERIALS
A. Portland Cement: ASTM C150, Type II.
B. Sand: ASTM C144 except graded in accordance with ANSI A42.2, natural or manufactured sand graded as follows:
Sand by Volume:

Sieve Size	Maximum	Minimum
No. 4	-	0
No. 8	0	10
No. 16	10	40
No. 30	30	65
No. 50	70	90
No. 100	95	100

Color for Job-Mixed Finish Coats: White.
C. Lime: ASTM C206, hydrated, Type S.
D. Base-Coat Mixes for Use over Metal Lath: Scratch and brown coats for three-coat plasterwork as follows:
Portland Cement Mixes:
Scratch Coat: For cementitious material, mix 1 part portland cement and 0 to 3/4 parts lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material (sum of separate volumes of each component material).
Brown Coat: For cementitious material, mix 1 part portland cement and 0 to 3/4 parts lime. Use 3 to 5 parts aggregate per part of cementitious material (sum of separate volumes of each component material).
E. Cement Plaster Finish Coat: Mill-mixed, waterproof finish requiring addition of water only. Color as selected by the Architect.
F. Water: Clean and potable, free from impurities detrimental to plaster, lathing or framing.
G. Waterproofing Agents:

1. In Portland Cement Scratch and Brown Coats: "Ali-Cite Waterproofing Cementing Compound" distributed by Concrete Improvement Products Co., Novato, California; A.C. Horn "Hydrotite"; Sonneborn Co., "Hydrocide Powder"; or approved equal.
2. In Portland Cement Finish Coat: "Clear Seal Concentrate" distributed by Concrete Improvement Products Co: Novato, California; or approved equal.

H. Bonding Agents: Larsen Products Corp.: "Weld-Crete"; or approved equal.

2.03 PLASTER SYSTEMS

A. Portland Cement Plaster on Metal Lath:
1. Thickness: 7/8 inch thick at vertical surfaces; 5/8 inch thick at horizontal surfaces.
2. Scratch and Brown Coats (By Volume): One part Portland cement, four parts sand, 1/10 part maximum hydrated lime and eight ounces "Ali-Cite" for each sack of cement.
3. Finish Coat: Prepared finish mix, requiring addition of water and 1/2 gallon "Clear Seal" for each 90 pounds of dry mix.
4. Finish Texture: As selected. See drawings.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Inspect areas and surfaces scheduled to receive lath and plaster and verify following:
1. Proper alignment of support systems.
2. Complete installation of blocking, bracing, and backing members in support systems.
3. Adequate scaffolding.
4. Verify that all required inspections have been received for materials and systems that will be concealed by the installation of the work of this Section.

B. Do not start installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Coordinate details with other work supporting, adjoining, or fastening to lath and plaster.

3.03 INSTALLATION

A. General Requirements: Install lath and related accessories straight, plumb, or level as required, to provide appropriate thickness of plaster.

B. Paper Backing:
1. The paper backing shall be attached to, or held in place by, the metal lathing, and shall not obstruct the furred spacing of the lath.
2. Provide Grade B paper at all parapet caps, ledges and other horizontal surface locations requiring a "vapor resistant" barrier; use Grade D at all other locations unless otherwise indicated.
3. Apply paper in a shingled fashion, lapped not less than 2 inches at horizontal joints and not less than 6 inches at vertical joints. Schedule application so as to preclude prolonged exposure of the paper to the sun or inclement weather.

C. Metal Lath Application:
1. Install in accordance with ML/SFA and the UBC unless otherwise noted.
2. Furr out metal lath 1/4" over solid backing or supports greater than 1-5/8 inches in width, by self-furring lath or by special furring nails.
3. Hang lath at openings with cut-out to include at least one and possible two opening corners (same as panel of gypsum board might be cut out to

include entire opening). Horizontal joints in line with head or vertical joints in line with jamb will not be permitted.

4. Attachments for securing metal lath to supports shall be spaced not more than 6 inches on center.
5. Apply metal lath taut, with the long dimension at right angles to supporting members.
6. Where metal lath occurs over gypsum sheathing, screw attach metal lath to studs, not to gypsum sheathing.
7. Stagger end laps of adjacent lath panels. Lace ends of lath with 18 gauge galvanized annealed steel wire. Provide the following end and side laps:

Lath Material	Side Lap	End Lap
Expanded Metal Lath	1/2 inch	1 inch
Wire Lath	1 inch (or 1 mesh)	1 inch

8. Where lath abuts or penetrates, or is penetrated by, a structural element such as a soffit, column, wall, or floor slab, the lath shall terminate at a casing bead, control joint, or similar device.
9. Where lath abuts or penetrates, or is penetrated by, a non-structural element such as a soffit, column, wall, or floor slab, the lath may be carried around the change of direction, but must be carried to at least the first supporting member.
10. Provide a weep screed at the foundation plate line or below, on all stud walls. Paper and lath shall terminate on flange of the weep screed.

D. Accessories:
1. Unless noted to receive formed metal edge or corner guards, apply corner beads at all external plaster corners using single lengths without joints.
2. Install casing beads at terminations of all plaster surfaces unless otherwise shown.
3. Use screeds of the required plaster system dimension to control plaster thickness.
4. Install control and expansion joints in exterior plaster work as noted or at maximum 10 foot centers; verify all expansion joint locations with the Architect.
5. Exterior Accessories:
   a. Install continuous runs except where joint intersections are permitted. In joining straight runs, lap joint sufficiently to maintain alignment while permitting movement.

E. Addition of Admixtures: When plastic or waterproof cement is used, no lime or other plasticizer may be added to the cement plaster at the time of mixing.

F. Plaster Application:
1. Methods and workmanship for Portland cement plastering systems shall meet requirements of ASTM C-926 and ANSI A42.3, and UBC. Measure materials in approved calibrated containers. Measuring materials with shovels will not be permitted.
2. Mix and apply bond agent to concrete and masonry surfaces in strict accordance with approved manufacturer's directions
3. Brown coat shall be rodded and floated. No darbies permitted.
4. Apply mill-mixed prepared cement plaster finish in strict accordance with approved manufacturer's directions
5. Horizontal stage joinings within any wall surface or area will not be permitted. Schedule work to permit completion of entire area, bounded by natural breaking points, from top to bottom within one day period whether operation be scratched, brown, or finish coating.

6. Machine application will be permitted at the Contractor's option and expense, provided equipment and method are approved by the Architect.
7. Grout hollow-metal frames, bases, and similar work occurring in plastered areas, with base-coat plaster material, before lathing where necessary. Grout at least 6 inches (152 mm) at each jamb anchor.
8. Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground, unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.
9. Plaster Finish Coats: Apply to provide float, or smooth steel trowel finish as indicated on the drawings.

G. Plaster Curing:
1. Keep Portland cement systems damp for at least 48 hours after application.
2. Apply water in fine fog spray.
3. Protect work from uneven and excessive evaporation during hot, dry weather and from strong blasts of wind.

H. Defective Work: Correct conditions in violation of these specifications by removing to whatever extent correction requires and replace with acceptable work.

END OF SECTION

SECTION 09 29 00 - GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:
   1. Interior gypsum wallboard.
   2. Tile backing panels.

1.03 DEFINITIONS

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

1.04 SUBMITTALS

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

1.05 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For gypsum board assemblies with fire-resistance ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Fire-Resistance-Rated Assemblies: Indicated by design designations from GA-600, "Fire Resistance Design Manual."

B. Gypsum Board Finish Mockups: Before finishing gypsum board assemblies, install mockups of at least 100 sq. ft. (9 sq. m) in surface area to demonstrate aesthetic effects and qualities of materials and execution.
   1. Install mockups for the following applications:
      a) Surfaces indicated to receive textured paint finishes.
   2. Simulate finished lighting conditions for review of mockups.
   3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Stack gypsum panels flat to prevent sagging.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

PART 2 - PRODUCTS

2.01 INTERIOR GYPSUM WALLBOARD

A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.

B. Gypsum Wallboard: ASTM C 36.
1. Type X (where indicated):
a) Thickness: 5/8 inch (15.9 mm).
b) Long Edges: Tapered.
c) Location: As indicated .

2.02 RESTROOMS, JANITORIAL, STORAGE AREAS

A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.

B. Water-Resistant Gypsum Backing Board: ASTM C 630/C 630M.
1. Core: 5/8 inch (15.9 mm), regular type.

C. Cementitious backer board for tile locations, Denshield or approved equal. “Greenboard” is not acceptable at tile installations.

2.03 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.
1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet].
2. Shapes:
a) Cornerbead: Use at outside corners.
b) L-Bead: L-shaped; exposed long leg receives joint compound; use where indicated.

2.04 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475.

B. Joint Tape:
1. Interior Gypsum Wallboard: Paper.
2. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
   a) Use setting-type compound for installing paper-faced metal trim accessories.
3. Fill Coat: For second coat, use setting-type, sandable topping compound.
4. Finish Coat: For third coat, use setting-type, sandable topping compound.

D. Joint Compound for Tile Backing Panels:
1. Water-Resistant Gypsum Backing Board: Use setting-type taping and setting-type, sandable topping compounds.

2.05 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Contractor shall float, patch, repair, or skim existing wall surfaces as required, in order to achieve an acceptable wall substrate for the application of a new wall finish.

3.02 APPLYING AND FINISHING PANELS, GENERAL

A. Gypsum Board Application and Finishing Standards: ASTM C 840 and GA-216.

B. Install ceiling board panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install gypsum panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Attach gypsum panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

F. Attach gypsum panels to framing provided at openings and cutouts.

G. Form control and expansion joints with space between edges of adjoining gypsum panels.

H. Cover both faces of steel stud partition framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect open concrete coffers, concrete joists, and other structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by coffers, joists, and other structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.

I. Isolate perimeter of non-load-bearing gypsum board partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations, and trim edges with U-bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

J. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's written recommendations.
1. Space screws a maximum of 12 inches (304.8 mm) o.c. for vertical applications.

K. Space fasteners in panels that are tile substrates a maximum of 8 inches (203.2 mm) o.c.

3.03 PANEL APPLICATION METHODS

A. Single-Layer Application:
1. On ceilings, apply gypsum panels before wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing) or horizontally (perpendicular to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
a) Stagger abutting end joints not less than one framing member in alternate courses of board.
b) At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.

B. Single-Layer Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Tile Backing Panels:
1. Water-Resistant Gypsum Backing Board: Install at showers, toilet, and locker rooms, and where indicated. Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.

2. Areas Not Subject to Wetting: Install standard gypsum wallboard panels to produce a flat surface except at showers, tubs, and other locations indicated to receive water-resistant panels.
3. Where tile backing panels abut other types of panels in the same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.04 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

3.05 FINISHING GYPSUM BOARD ASSEMBLIES

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Contractor shall install a new “orange peel” wall finish texture over the existing wall texture at all existing wall locations.

E. Contractor shall float, patch, repair, or skim existing wall surfaces as required, in order to achieve an acceptable wall substrate for the application of a new wall finish.

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

END OF SECTION

SECTION 09 29 00 - GYPSUM BOARD ASSEMBLIES

PART 4 - GENERAL

4.01 RELATED DOCUMENTS

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

4.02 SUMMARY

A. This Section includes the following:
   1. Interior gypsum wallboard.
   2. Tile backing panels.

4.03 DEFINITIONS

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

4.04 SUBMITTALS

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

4.05 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For gypsum board assemblies with fire-resistance ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Fire-Resistance-Rated Assemblies: Indicated by design designations from GA-600, "Fire Resistance Design Manual."

B. Gypsum Board Finish Mockups: Before finishing gypsum board assemblies, install mockups of at least 100 sq. ft. (9 sq. m) in surface area to demonstrate aesthetic effects and qualities of materials and execution.
   1. Install mockups for the following applications:
      a) Surfaces indicated to receive textured paint finishes.
   2. Simulate finished lighting conditions for review of mockups.
   3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

4.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Stack gypsum panels flat to prevent sagging.

4.07 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

PART 5 - PRODUCTS

5.01 INTERIOR GYPSUM WALLBOARD

A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.

B. Gypsum Wallboard: ASTM C 36.
1. Type X (where indicated):
a) Thickness: 5/8 inch (15.9 mm).
b) Long Edges: Tapered.
c) Location: As indicated .

5.02 RESTROOMS, JANITORIAL, STORAGE AREAS

A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.

B. Water-Resistant Gypsum Backing Board: ASTM C 630/C 630M.
1. Core: 5/8 inch (15.9 mm), regular type.

C. Cementitious backer board for tile locations, Denshield or approved equal. “Greenboard” is not acceptable at tile installations.

5.03 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.
1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet].
2. Shapes:
a) Cornerbead: Use at outside corners.
b) L-Bead: L-shaped; exposed long leg receives joint compound; use where indicated.

5.04 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475.

B. Joint Tape:
1. Interior Gypsum Wallboard: Paper.
2. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
   a) Use setting-type compound for installing paper-faced metal trim accessories.
3. Fill Coat: For second coat, use setting-type, sandable topping compound.
4. Finish Coat: For third coat, use setting-type, sandable topping compound.

D. Joint Compound for Tile Backing Panels:
1. Water-Resistant Gypsum Backing Board: Use setting-type taping and setting-type, sandable topping compounds.

5.05 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.

PART 6 - EXECUTION

6.01 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Contractor shall float, patch, repair, or skim existing wall surfaces as required, in order to achieve an acceptable wall substrate for the application of a new wall finish.

6.02 APPLYING AND FINISHING PANELS, GENERAL

A. Gypsum Board Application and Finishing Standards: ASTM C 840 and GA-216.

B. Install ceiling board panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install gypsum panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Attach gypsum panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

F. Attach gypsum panels to framing provided at openings and cutouts.

G. Form control and expansion joints with space between edges of adjoining gypsum panels.

H. Cover both faces of steel stud partition framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect open concrete coffers, concrete joists, and other structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by coffers, joists, and other structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.

I. Isolate perimeter of non-load-bearing gypsum board partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations, and trim edges with U-bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

J. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's written recommendations.
1. Space screws a maximum of 12 inches (304.8 mm) o.c. for vertical applications.

K. Space fasteners in panels that are tile substrates a maximum of 8 inches (203.2 mm) o.c.

6.03 PANEL APPLICATION METHODS

A. Single-Layer Application:
1. On ceilings, apply gypsum panels before wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing) or horizontally (perpendicular to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
a) Stagger abutting end joints not less than one framing member in alternate courses of board.
b) At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.

B. Single-Layer Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Tile Backing Panels:
1. Water-Resistant Gypsum Backing Board: Install at showers, toilet, and locker rooms, and where indicated. Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.

2. Areas Not Subject to Wetting: Install standard gypsum wallboard panels to produce a flat surface except at showers, tubs, and other locations indicated to receive water-resistant panels.
3. Where tile backing panels abut other types of panels in the same plane, shim surfaces to produce a uniform plane across panel surfaces.

6.04 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

6.05 FINISHING GYPSUM BOARD ASSEMBLIES

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Contractor shall install a new “orange peel” wall finish texture over the existing wall texture at all existing wall locations.

E. Contractor shall float, patch, repair, or skim existing wall surfaces as required, in order to achieve an acceptable wall substrate for the application of a new wall finish.

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

END OF SECTION

SECTION 09 51 23 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes acoustical panels and exposed suspension systems for ceilings.

B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete at ceilings.

1.03 DEFINITIONS

A. AC: Articulation Class.

B. CAC: Ceiling Attenuation Class.

C. LR: Light Reflectance coefficient.

D. NRC: Noise Reduction Coefficient.

1.04 SUBMITTALS

A. Samples for Initial Selection: For components with factory-applied color finishes.

B. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
   1. Acoustical Panel: Set of 6-inch- (150-mm-) square Samples of each type, color, pattern, and texture.
   2. Exposed Suspension System Members, Moldings, and Trim: Set of 12-inch- (300-mm-) long Samples of each type, finish, and color.

1.05 QUALITY ASSURANCE

A. Acoustical Testing Agency Qualifications: An independent testing laboratory, or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548. NVLAP-accredited laboratories must document accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation" listing the test methods specified.

B. Source Limitations:
   1. National Purchasing Agreement Vendor: Armstrong World Industries, Inc., contact – Denise Warful, 800/442-4212.
   2. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:
      a) Smoke-Developed Index: 450 or less.

C. Seismic Standard: Provide acoustical panel ceilings designed and installed to withstand the effects of earthquake motions according to the following:
   1. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with ASTM E 580.
   2. UBC Standard 25-2, "Metal Suspension Systems for Acoustical Tile and for Lay-in Panel Ceilings."

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.07 PROJECT CONDITIONS

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

1.08 COORDINATION

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

1.09 EXTRA MATERIALS

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

PART 2 - PRODUCTS

2.01 ACOUSTICAL PANELS, GENERAL

A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
   1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface per ASTM E 795.

B. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
   1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.02 MINERAL-BASE ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING.

A. Products:
   1. As indicated on drawings", color – white.

B. Classification: Provide panels complying with ASTM E 1264, Type III Form 2, and Pattern CDK.

C. Edge Detail: Reveal sized to fit flange of exposed suspension system members.

2.03 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.

B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.

C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated.
   1. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.

D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
   1. Zinc-Coated Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
   2. Nickel-Copper-Alloy Wire: ASTM B 164, nickel-copper-alloy UNS No. N04400.
   3. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) diameter wire.

E. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

F. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels in-place.

2.04 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING.

A. Products:
1. Panel Type A: Armstrong, 15/16” Prelude, color – white.

B. Wide-Face, Capped, Double-Web,Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 (Z90) coating designation, with prefinished 15/16-inch- (24-mm-) wide metal caps on flanges.
1. Structural Classification: Intermediate -duty system.
2. End Condition of Cross Runners: Butt-edge type.
3. Face Design: Flat, flush.
4. Cap Material: Steel cold-rolled sheet.
5. Cap Finish: Painted. Color as selected by Architect.

2.05 METAL EDGE MOLDINGS AND TRIM

A. Roll-Formed Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.
1. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

PART 3 - EXECUTION

3.01 EXAMINATION

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

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

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

3.03 INSTALLATION, GENERAL

A. General: Install acoustical panel ceilings to comply with UBC Standard 25-2 and seismic requirements indicated, per manufacturer's written instructions.

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and
4. hangers to support ceiling loads within performance limits established by referenced standards and publications.
5. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
7. Do not attach hangers to steel deck tabs.
8. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
   1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
   2. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.66 m). Miter corners accurately and connect securely.
   3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
   1. Arrange directionally patterned acoustical panels as follows:
      a) As indicated on reflected ceiling plans.
      b) Install panels with pattern running in one direction parallel to long axis of space.
   2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
   3. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.

4. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

3.04 CLEANING

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

END OF SECTION

SECTION 09 65 19 - RESILIENT FLOOR TILE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:
   1. Vinyl composition tile (VCT).
   2. Resilient wall base and accessories.

1.03 SUBMITTALS

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

B. Samples for Verification: Full-size units of each color and pattern of resilient floor tile required.
   1. Resilient Wall Base and Accessories: Manufacturer's standard-size Samples, but not less than 12 inches (300 mm) long, of each resilient product color and pattern required.

C. Maintenance Data: For resilient products to include in maintenance manuals.

1.04 QUALITY ASSURANCE

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

B. Perform moisture test of concrete floor slab in accordance with this section.

1.05 DELIVERY, STORAGE, AND HANDLING

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

1.06 PROJECT CONDITIONS

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

B. After postinstallation period, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) Insert temperature or more than 95 deg F (35 deg C) Insert temperature.

C. Close spaces to traffic during floor covering installation.

D. Close spaces to traffic for 48 hours after floor covering installation.

E. Install resilient products after other finishing operations, including painting, have been completed.

1.07 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Floor Tile: Furnish 1 box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

2.02 COLORS AND PATTERNS

A. Colors and Patterns: As selected by Architect from manufacturer's full range. Bidders shall assume for bidding purposes a random floor pattern of 4 colors throughout the facility. Pattern shall be as selected by Architect.

2.03 RESILIENT WALL BASE

A. Wall Base: ASTM F 1861.
   1. Armstrong World Industries, Inc.
   2. Azrock Commercial Flooring, DOMCO.
   3. Burke Mercer Flooring Products.
   4. Marley Flexco (USA), Inc.
   5. Roppe Corporation.

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

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

D. Height: 6 inches (102 mm).

E. Lengths: Coils in manufacturer's standard length.

F. Outside Corners: Premolded.

G. Inside Corners: Premolded.

H. Surface: Smooth.

2.04 RESILIENT MOLDING ACCESSORY

A. Description: Carpet edge for glue-down applications.
   1. Burke Mercer Flooring Products.
   2. Marley Flexco (USA), Inc.
   3. Roppe Corporation.

B. Material: Vinyl.

C. Profile and Dimensions: As indicated.

2.05 INSTALLATION MATERIALS

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

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

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

PART 3 - EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
   3. Moisture Testing:
      a) Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
      b) Perform tests recommended by manufacturer and submit test results to Architect. Proceed with installation only after substrates pass testing.
      c) In the event that moisture vapor emissions exceed 3lbs./1000 sq. ft./24 hrs., the Contractor, at his expense, shall install a barrier coat and moisture

sealer, “J&J Commercialon 877 Premium Barrier Coat”. Contractor shall apply two coats per manufacturer’s instructions, prior to installation of the flooring material.

C. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

D. Access Flooring Panels: Remove protective film of oil or other coating using method recommended by access flooring manufacturer.

E. Contractor shall grind, patch, float the floor substrate as required to create an even and level flooring surface.

F. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.

G. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
   1. Do not install resilient products until they are same temperature as space where they are to be installed.

H. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.03 RESILIENT WALL BASE INSTALLATION

A. Apply wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

B. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

C. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

D. Do not stretch wall base during installation.

E. On masonry surfaces or other similar irregular substrates, fill voids along top edge of wall base with manufacturer's recommended adhesive filler material.

F. Premolded Corners: Install premolded corners before installing straight pieces.

3.04 RESILIENT ACCESSORY INSTALLATION

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

3.05 CLEANING AND PROTECTION

A. Perform the following operations immediately after completing resilient product installation:
   1. Remove adhesive and other blemishes from exposed surfaces.
   2. Sweep and vacuum surfaces thoroughly.
   3. Damp-mop surfaces to remove marks and soil.
      a) Do not wash surfaces until after time period recommended by manufacturer.

B. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.
   1. Apply protective floor polish to horizontal surfaces that are free from soil, visible adhesive, and surface blemishes if recommended in writing by manufacturer.
      a) Use commercially available product acceptable to manufacturer.

      b) Coordinate selection of floor polish with Owner's maintenance service.
   2. Cover products installed on horizontal surfaces with undyed, untreated building paper until Substantial Completion.
   3. Do not move heavy and sharp objects directly over surfaces. Place hardboard or plywood panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.

END OF SECTION

SECTION 09 91 00 - PAINTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

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

1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

B. Paint exposed surfaces, except where these Specifications indicate that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Architect will select from a full range of colors and finishes available.

1. Painting includes field painting of exposed bare and covered pipes and ducts (including
color coding), hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory-applied final finish.

C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and label, unless otherwise noted.

1. Prefinished items include the following factory-finished components:

a) Acoustical wall panels.
b) Metal toilet enclosures.
c) Metal lockers.
d) Elevator entrance doors and frames.
e) Elevator equipment.
f) Light fixtures (Not including trims).
g) Drinking Fountains.
h) Fire Extinguisher Cabinets

2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:

a) Furred areas.
b) Ceiling plenums.
c) Pipe spaces.
d) Duct shafts.
e) Elevator shafts.

3. Finished metal surfaces include the following:

a) Anodized aluminum, UON.
b) Stainless steel.
c) Chromium plate.
d) Copper and copper alloys.
e) Bronze and brass.

4. Operating parts include moving parts of operating equipment and the following:

a) Valve and damper operators.
b) Linkages.
c) Sensing devices.
d) Motor and fan shafts.

5. Labels: Do not paint over UL, FMG, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

D. Related Sections include the following:
1. Division 2 Section "Cement Concrete Pavement" for traffic-marking paint.
2. Division 5 Section "Structural Steel" for shop priming structural steel.
3. Division 5 Section "Metal Fabrications" for shop priming ferrous metal.
4. Division 8 Section "Steel Doors and Frames" for factory priming steel doors and frames.
5. Division 9 Section "Gypsum Board Assemblies" for surface preparation of gypsum board.

1.03 DEFINITIONS

A. General: Standard coating terms defined in ASTM D 16 apply to this Section.

1. Semigloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
2. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.

1.04 SUBMITTALS

A. Product Data: For each paint system indicated. Include block fillers and primers.

1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.

2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.

B. Samples for Verification: For each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.

1. Provide stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.

2. Provide a list of materials and applications for each coat of each Sample. Label each Sample for location and application.

3. Submit Four samples on the following substrates for Architect's review of color and texture only:

    a) Concrete: 4-inch- (100-mm-) square samples for each color and finish.

    b) Stained or Natural Wood: 4-by-8-inch (100-by-200-mm) Samples of natural- or stained-wood finish on representative surfaces.

1.05 QUALITY ASSURANCE

A. Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Source Limitations: Obtain for each coating system from the same manufacturer as the finish coats.

C. Benchmark Samples (Mockups): Provide a full-coat benchmark finish sample for each type of coating and substrate required. Comply with procedures specified in PDCA P5. Duplicate finish of approved sample Submittals.

1. Architect will select one room or surface to represent surfaces and conditions for application of each type of coating and substrate.

    a) Wall Surfaces: Provide samples on at least 50 sq. ft..

    b) Small Areas and Items: Architect will designate items or areas required.

2. Apply benchmark samples, according to requirements for the completed Work, after permanent lighting and other environmental services have been activated. Provide required sheen, color, and texture on each surface.
    a) After finishes are accepted, Architect will use the room or surface to evaluate coating systems of a similar nature.

3. Final approval of colors will be from benchmark samples.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:

1. Product name or title of material.
2. Product description (generic classification or binder type).
3. Manufacturer's stock number and date of manufacture.
4. Contents by volume, for pigment and vehicle constituents.
5. Thinning instructions.
6. Application instructions.
7. Color name and number.
8. VOC content.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain storage containers in a clean condition, free of foreign materials and residue.

1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily.

1.07 PROJECT CONDITIONS

A. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F (10 and 32 deg C).

B. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F (7 and 35 deg C).

C. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products: Subject to compliance with requirements.
1. Benjamin Moore & Co. (Benjamin Moore).
2. Dunn Edwards Paints

2.02 PAINT MATERIALS, GENERAL

A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

C. Colors: As selected by Architect from manufacturer's full range. Contractor shall assume for bidding purposes that a min. of 6 interior colors and 6 exterior colors will used at various locations and quantities throughout the project.

2.03 EXTERIOR PRIMERS

A. Exterior Concrete and Masonry Primer: Factory-formulated alkali-resistant acrylic-latex primer for exterior application.

1. Benjamin Moore; Moore's Acrylic Masonry Sealer No. 066: Applied at a dry film thickness of not less than 0.7 mils (0.018 mm).

B. Exterior Ferrous-Metal Primer: Factory-formulated rust-inhibitive metal primer for exterior application.

1. Benjamin Moore; Moore's IMC Alkyd Metal Primer No. M06: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).

2.04 INTERIOR PRIMERS

A. Interior Gypsum Board Primer: Factory-formulated latex-based primer for interior application.

1. Benjamin Moore; Moorcraft Super Spec Latex Enamel Undercoater & Primer Sealer No. 253: Applied at a dry film thickness of not less than 1.2 mils (0.030 mm).

B. Interior Ferrous-Metal Primer: Factory-formulated quick-drying rust-inhibitive alkyd-based metal primer.

1. Benjamin Moore; Moore's IMC Alkyd Metal Primer No. M06: Applied at a dry film thickness of not less than 2.0 mils (0.051 mm).

2.05 EXTERIOR FINISH COATS

A. Exterior Semigloss Acrylic Enamel: Factory-formulated semigloss waterborne acrylic-latex enamel for exterior application.

1. Benjamin Moore; Moorcraft Super Spec Latex House & Trim Paint No. 170: Applied at a dry film thickness of not less than 1.1 mils (0.028 mm).

2.06 INTERIOR FINISH COATS

A. Interior Acrylic Enamel: Factory-formulated semigloss or flat acrylic-latex enamel for interior application.
1. Benjamin Moore; Moorcraft Super Spec Latex Satin Enamel: Applied at a dry film thickness of not less than 1.2 mils (0.031 mm).

2.07 INTERIOR WOOD STAINS AND VARNISHES

A. Open-Grain Wood Filler: Factory-formulated paste wood filler applied at spreading rate recommended by manufacturer.

1. Benjamin Moore; Benwood Paste Wood Filler No. 238.

B. Interior Wood Stain: Factory-formulated alkyd-based penetrating wood stain for interior application applied at spreading rate recommended by manufacturer.

1. Benjamin Moore; Benwood Penetrating Stain No. 234.

C. Clear Sanding Sealer: Factory-formulated fast-drying alkyd-based clear wood sealer applied at spreading rate recommended by manufacturer.

1. ICI Dulux Paints; 1902-0000 WoodPride Interior Satin Polyurethane Varnish.

D. Interior Alkyd- or Polyurethane-Based Clear Satin Varnish: Factory-formulated alkyd- or polyurethane-based clear varnish.

1. Benjamin Moore; Benwood Interior Wood Finishes Polyurethane Finishes Low Lustre No. 435.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for paint application.

1. Proceed with paint application only after unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.

2. Start of painting will be construed as Applicator's acceptance of surfaces and conditions within a particular area.

3. Notify Architect about anticipated problems when using the materials specified over substrates primed by others.

3.02 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.

1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove and reprime.

2. Cementitious Materials: Prepare concrete, concrete unit masonry, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as

required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.

a) Use abrasive blast-cleaning methods if recommended by paint manufacturer.

b) Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces if moisture content exceeds that permitted in manufacturer's written instructions.

c) Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum before painting.

3. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.

a) Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.

b) Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and back sides of wood, including cabinets, counters, cases, and paneling

c) If transparent finish is required, backprime with spar varnish.

d) Backprime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on back side.

e) Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.

4. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC's recommendations.

a) Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as the shop coat.

D. Material Preparation: Mix and prepare paint materials according to manufacturer's written instructions.

1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.

2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.

3. Use only thinners approved by paint manufacturer and only within recommended limits.

E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.03 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

1. Paint colors, surface treatments, and finishes are indicated in the paint schedules.

2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.

3. Provide finish coats that are compatible with primers used.

4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.

5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.

6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.

7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.

8. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.

9. Sand lightly between each succeeding enamel or varnish coat.

B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.

2. Omit primer over metal surfaces that have been shop primed and touchup painted.

3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give

special attention to ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.

4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.

C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.

2. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.

3. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.

D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.

E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and occupied spaces.

F. Mechanical items to be painted include, but are not limited to, the following:

1. Tanks that do not have factory-applied final finishes.

2. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.

3. Mechanical equipment that is indicated to have a factory-primed finish for field painting.

G. Electrical items to be painted include, but are not limited to, the following:

1. Panelboards.

H. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.

I. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

J. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.

K. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.04 FIELD QUALITY CONTROL

A. Owner reserves the right to invoke the following test procedure at any time and as often as Owner deems necessary during the period when paint is being applied:

1. Owner will engage a qualified independent testing agency to sample paint material being used. Samples of material delivered to Project will be taken, identified, sealed, and certified in the presence of Contractor.

2. Testing agency will perform appropriate tests as required.

3.05 CLEANING

A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.

1. After completing painting, clean paint-spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

3.06 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.

1. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.07 EXTERIOR PAINT SCHEDULE

A. Concrete, Stucco, and Concrete Unit Masonry: Provide the following finish systems over exterior concrete, stucco, and brick masonry substrates:

1. Acrylic-Enamel Finish: Two finish coats over a primer.
   a) Primer: Exterior concrete and masonry primer.
   b) Finish Coats: Exterior semigloss acrylic enamel.
2. Clear concrete/masonry sealer

B. Ferrous Metal: Provide the following finish systems over exterior ferrous metal. Primer is not required on shop-primed items:

1. Semigloss Acrylic-Enamel Finish: Two finish coats over a rust-inhibitive primer.

a) Primer: Exterior ferrous-metal primer.
b) Finish Coats: Exterior semigloss acrylic enamel.

3.08 INTERIOR PAINT SCHEDULE

A. Gypsum Board: Provide the following finish systems over interior gypsum board surfaces:

1. Eggshell Acrylic-Enamel Finish: Two finish coats over a primer.
   a) Primer: Interior gypsum board primer.
   b) Finish Coats: Interior eggshell acrylic enamel.

2. Flat Acrylic-Enamel Finish: Two finish coats over a primer.
   a) Primer: Interior gypsum board primer
   b) Finish Coats: Interior Flat acrylic enamel.

B. Ferrous Metal: Provide the following finish systems over ferrous metal:

1. Semigloss Acrylic-Enamel Finish: Two finish coats over a primer.
   a) Primer: Interior ferrous-metal primer.
   b) Finish Coats: Interior semigloss acrylic enamel.

3.09 INTERIOR STAIN AND NATURAL-FINISH WOODWORK SCHEDULE

A. Stained Woodwork: Provide the following stained finishes over new interior woodwork:

1. Alkyd-Based Stain Satin-Varnish Finish: Two finish coats of alkyd-based clear satin varnish over a sealer coat and interior wood stain. Wipe wood filler before applying stain.
   a) Stain Coat: Interior wood stain.
   b) Sealer Coat: Clear sanding sealer.
   c) Finish Coats: Interior alkyd- or polyurethane-based clear satin varnish.

END OF SECTION

SECTION 10 14 00 - SIGNAGE

PART 1 - PART 1 - GENERAL

1. RELATED DOCUMENTS
   a) Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
2. SUMMARY
   1. This Section includes exterior and interior signage.
3. DEFINITIONS
   a) ADA-ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines."
4. SUBMITTALS
   a) Shop Drawings: Show fabrication and installation details for signs.
      1. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
      2. Provide message list, typestyles, graphic elements, including tactile characters and Braille, and layout for each sign.
   b) Samples for Verification: For each of the following products and for the full range of color, texture, and sign material indicated, of sizes indicated:
      1. Panel Signs: Not less than 12 inches square.
      2. Accessories: Manufacturer's full-size unit.
   d) Maintenance Data: For signs to include in maintenance manuals.
   e) Warranty: Provide warranty in accordance with this specification section, in addition to the warranty and/or guarantee requirements stated elsewhere in Contract Documents including, but not limited to, Part III: Contract Documents Contract, Part IV: General Conditions, and Division 1 of technical specifications.
5. QUALITY ASSURANCE
   b) Installer Qualifications: An employer of workers trained and approved by manufacturer.
   c) Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
   d) Source Limitations for Signs: Obtain each sign type indicated from one source from a single manufacturer.
   f) Regulatory Requirements: Comply with applicable provisions in ADA-ABA Accessibility Guidelines.
6. PROJECT CONDITIONS

b) Weather Limitations: Proceed with installation only when weather conditions permit installation of signs in exterior locations to be performed according to manufacturers' written instructions and warranty requirements.

c) Field Measurements: Verify recess openings by field measurements before fabrication and indicate measurements on Shop Drawings.

7. COORDINATION

a) Coordinate placement of anchorage devices with templates for installing signs.

8. WARRANTY

A. Provide manufacturer's written warranty in which manufacturer agrees to repair or replace signage that fails in materials or workmanship within specified warranty period as indicated below. Manufacturer may not disclaim any implied warranty such as merchantability or fitness for a particular purpose. Both the expressed and implied terms of the warranty shall be read together for the benefit of the City.

1. Failures include, but are not limited to, the following:

i. Deterioration of metal and polymer finishes beyond normal weathering.
ii. Deterioration of embedded graphic image colors and sign lamination.

2. Warranty Period: Five years from date of Project Acceptance.

PART 2 - PRODUCTS

1. SIGNS

a) Exterior Signs:

1. All building entrances that are accessible to and usable by persons with disabilities shall be identified with at least one standard sign (International accessibility symbol) with additional directions signs, as required, to be visible to persons along approaching pedestrian ways and paths-of-travel.

b) Interior Signs:

1. General: Each room shall be provided with Room Identification signage. All Signage shall comply with the 2016 California Building Code (CBC), Section 11B-703 Signs.
2. All doors within the building shall receive signage With California Braille identification (larger than typical ADA Braille). The Braille shall be grade 2 with 1/10th inch on centers within each cell with 2/10th inch between cells. Dots shall be raised 1/40th inch above background. Letters and numbers on signs shall have a width-to-height ratio of between 3:5 and 1:1 and a stroke with to height ration between 1:5 and 1:10. Signs shall be mounted 60” A.F.F. and 4”-12” from strike side of doors. Each toilet room shall have required identification signs (on Door and on adjacent wall), which contain the international symbol of accessibility in white on a blue background, color number 15090 in Federal Standard 595B.

2. MATERIALS

c) Aluminum Sheet and Plate: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of Alloy 5005-H32.

e) Fiberglass Sheet: Molded, seamless, thermosetting, glass-fiber-reinforced polyester panels with a minimum tensile strength of 15,000 psi when tested according to ASTM D 638 and with a minimum flexural strength of 30,000 psi when tested according to ASTM D 790.

f) Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), Type UVA (UV absorbing).

g) Applied Vinyl: Die-cut characters from vinyl film of nominal thickness of 3 mils with pressure-sensitive adhesive backing, suitable for exterior applications.

3. PANEL SIGNS

b) Exterior Panel Signs: Provide smooth sign panel surfaces constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch measured diagonally from corner to corner, complying with the following requirements:

1. Aluminum Sheet: 0.125 inch thick.
2. Fiberglass Sheet: 0.125-inch- thick sheet.
3. Edge Condition: Bullnose.
4. Corner Condition: Square.
5. Mounting: As indicated.
6. Color: As selected by Architect from manufacturer's full range.

f) Tactile and Braille Sign: Manufacturer's standard process for producing text and symbols complying with ADA-ABA Accessibility Guidelines and with ICC/ANSI A117.1. Text shall be accompanied by Grade 2 Braille. Produce precisely formed characters with square-cut edges free from burrs and cut marks; Braille dots with domed or rounded shape.

1. Panel Material: Opaque acrylic sheet.
2. Raised-Copy Thickness: Not less than 1/32 inch.

i) Applied Vinyl: Die-cut characters from vinyl film of nominal thickness of 3 mils with pressure-sensitive adhesive backing.

4. ACCESSORIES

b) Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

5. FABRICATION

a) General: Provide manufacturer's standard signs of configurations indicated.

1. Welded Connections: Comply with AWS standards for recommended practices in shop welding. Provide welds behind finished surfaces without distortion or discoloration of exposed side. Clean exposed welded surfaces of welding flux and dress exposed and contact surfaces.
2. Mill joints to tight, hairline fit. Form joints exposed to weather to exclude water penetration.
3. Preassemble signs in the shop to greatest extent possible. Disassemble signs only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation, in location not exposed to view after final assembly.

4. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.

6. FINISHES, GENERAL

a) Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

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

c) Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

7. ALUMINUM FINISHES

e) Color Anodic Finish: Manufacturer's standard Class 1 integrally colored or electrolytically deposited color anodic coating, 0.018 mm or thicker, in black applied over a polished (buffed) mechanical finish, complying with AAMA 611.

8. ACRYLIC SHEET FINISHES

a) Colored Coatings for Acrylic Sheet: For copy and background and frame colors, provide colored coatings, including inks, dyes, and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and that are UV and water resistant for five years for application intended.

PART 3 - EXECUTION

1. EXAMINATION

a) Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

b) Verify that items, including anchor inserts, are sized and located to accommodate signs.

c) Proceed with installation only after unsatisfactory conditions have been corrected.

2. INSTALLATION

a) Locate signs and accessories where indicated, using mounting methods of types described and complying with manufacturer's written instructions.

1. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.
1. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches of sign without encountering protruding objects or standing within swing of door.

d) Wall-Mounted Signs: Comply with sign manufacturer's written instructions except where more stringent requirements apply.

1. Two-Face Tape: Mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.

3. CLEANING AND PROTECTION

a) After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by City.

END OF SECTION

SECTION 10 21 13 - TOILET COMPARTMENTS

PART 1 - GENERAL

1.01 Work Included

A. Toilet Compartments

B. Urinal Screens

1.02 Related Sections

A. Support for ceiling-hung compartments.

B. Wall backing required to secure mounting brackets.

C. Support for floor-anchored compartments.

D. Toilet room accessories.

1.03 References (including but not limited to)

A. *National Fire Protection Association 101 Life Safety Code, 2006 Edition*, Chapter10

B. ANSI A117- 1986 *Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People*.

C. *International Building Code* (IBC), 2006 Edition, Chapters 8, 11, and 12.

D. *International Plumbing Code* (IPC), 2006 Edition, Chapter 3, Section 10.

E. Title 24, *California Code of Regulations*, Parts 2, 3, and 5.

F. ADA, *Accessibility Guidelines for Buildings and Facilities*, Federal Register Volume 56, Number 144, Rules and Regulations.

G. Fair Housing Amendments Act of 1988, *Accessibility Guidelines*, Federal Register Volume 56, Number 44.

H. Southern Building Code.

1.04 QUALITY ASSURANCE

A. Manufacturers

1. Bobrick 1082.67P Solid Phenolic Toilet Partitions with institutional hardware. Model numbers for compartments manufactured by Bobrick Washroom Equipment, Inc.,are listed to establish a standard of quality for design, function, materials, workmanship, and appearance. Other manufacturers may be submitted for evaluation by the architect by following the conditions of the substitutions clause. Unless approval is obtained ten days prior to the bid date, all bids shall be based on the standard of quality. The architect shall be the sole judge as to the acceptability of all products submitted for substitution.

2. Compartments shall be the product(s) of a single manufacturer.

3. Or equal approved by architect

1.05 Submittals

A. Comply with requirements of Section regarding submittals.

B. Manufacturer's Data

1. Provide required number copies of:

a. Product data sheets.

b. Installation instructions.

c. Replacement parts information.

C. Shop Drawings

1. Provide required number of copies of all shop drawings.

2. Show fabrication and erection of compartment assemblies, to extent not fully described by manufacturer's data sheets.

3. Show anchorage, accessory items and finishes.

4. Provide location drawings for bolt hole locations in supporting members for attachment of compartments.

D. Samples

1. Furnish scale model of compartments, including stile, shoe, door, door hardware, divider panel, and mounting brackets.

2. Furnish sections showing stile anchoring and leveling devices, concealed threaded inserts, panel and stile construction and edge construction.

1.06 Product Delivery, Storage, and Handling

A. Deliver items in manufacturer's original unopened protective packaging.

B. Store materials in original protective packaging to prevent physical damage or wetting.

C. Handle so as to prevent damage to finished surfaces.

1.07 Warranty

A. Furnish 25 year warranty for panels, doors, and stiles against breakage, corrosion, delamination, and defects in factory workmanship.

B. Furnish one-year guarantee against defects in material and workmanship for stainless steel door hardware and mounting brackets.

PART 2 - PRODUCTS

2.01 Configurations

A. National Fire Protection Association and International Building Code Interior Wall and Ceiling finish Class B

1. Toilet Compartments shall be:

Overhead-Braced 1082G.67P Duraline Series, Finish as selected from Manufacture’s full range.

2. Urinal Screens shall be:

Wall-Hung (1085.67 DuralineSeries, , Finish as selected from Manufacture’s full range.

3. Shower Stalls 1082.67 Shower Curtain must be recessed into head Rail.

2.02 Components/Materials

A. Stiles, Panels, Doors, Screens, and Benches

1. Solid phenolic material constructed of solidly fused plastic laminate with matte-finish melamine surfaces, colored face sheets, and black phenolic-resin core that are integrally bonded. Edges shall be black. Brown edges shall not be acceptable. Color and pattern as selected by architect from Bobrick standard colors.
2. For 1080 DuralineSeries: solid phenolic material shall meet National Fire Protection Association and International Building Code Interior Wall and Ceiling Finish Class B, Uniform Building Code Class II, ASTM E-84 Fire Resistance Standards: flame spread 69, smoke density 93.
3. Finish Thickness
   a. Stiles and doors shall be 3/4" (19mm).
   b. Panels and benches shall be 1/2" (13mm).

B. Hardware

1. All hardware to be 18-8, type-304 stainless steel with satin finish.
2. All hardware shall be concealed inside compartments with the exception of outswing doors, utilizing brass threaded inserts.
3. Hardware of chrome-plated “Zamak” and aluminum are unacceptable.

C. Vandal-Resistant Hardware (.67P)

1. Sliding door latch shall be 14-gauge (2mm) and shall slide on nylon track.
2. Sliding door latch shall require less than 5-lb force to operate. Twisting latch operation will not be acceptable.
3. Latch track shall be attached to door by flathead machine screws into factory-installed threaded brass inserts.
4. Latch handle shall have rubber bumper to act as door stop.
5. Latch shall allow door to be lifted over 8-gauge (4.4mm) keeper for emergency access.
6. Metal-to-metal connection shall withstand a direct pull of over 1,500 lb. per screw.

D. Hinges

1. Hinge shall be 14 gauge pin & barrel hinges
2. All doors shall be set to stay open, when patron leaves stall
3. Pin and barrel hinge shall be attached to door and stile by theft-resistant, one-way, stainless steel machine screws into threaded brass inserts.
4. Door shall be furnished with two 11-gauge (3mm) vinyl-coated door stops to resist door from being kicked out of compartment.
5. Door stops and keeper shall be secured with stainless steel, one-way, machine screws from inside of compartment to threaded brass inserts.

E. Clothes Hook shall be constructed of stainless steel and shall project no more than 1-1/8" (29mm) from face of door. Clothes hook shall be secured by theft-resistant, one-way stainless steel screws. Clothes hook shall be installed at all toilet compartments.

F. Mounting brackets shall be 18-gauge (1.2mm) stainless steel and extend full height of panel. U-channels shall be furnished for panel to stile mounting. Angle brackets shall be furnished for stile-to-wall and stile-to-panel mounting. Angle brackets shall be furnished for panel-to-wall mounting.

G. Leveling Device shall be 3/16" (5mm) hot rolled steel bar; chromate-treated and zinc-plated; through-bolted to base of solid phenolic stile.

H. Stile Shoe shall be one-piece, 4" (102mm) high, type-304, 22-gauge (0.8mm) stainless steel with satin-finish. Top shall have 90° return to stile. Patented one-piece shoe capable of adapting to 3/4" or 1" stile thickness and capable of being fastened (by clip) to stiles starting at wall line.

I. Headrail (Overhead-Braced) shall be satin finish, extruded anodized aluminum (.065" / 1. 65mm thick) with anti-grip profile.

PART 3 - EXECUTION

3.01 Inspection

A. Check areas scheduled to receive compartments for correct dimensions, plumbness of walls, and soundness of surfaces that would affect installation of mounting brackets.

B. Verify spacing of plumbing fixtures to assure compatibility with installation of compartments.

C. Do not begin installation of compartments until conditions are satisfactory.

3.02 Erection

A. Install compartments rigidly, straight, plumb, and level and in accordance with manufacturer's installation instructions.

B. Installation methods shall conform to manufacturer's recommendations for backing and proper support.

C. Conceal evidence of drilling, cutting, and fitting to room finish.

D. Maintain uniform clearance at vertical edge of doors.

3.03 Adjustment and Cleaning

A. Adjust hardware for proper operation after installation.

B. Set hinge cam on in-swinging doors to hold doors open when unlatched.

C. Set hinge cam on out-swinging doors to hold unlatched doors in closed position.

END OF SECTION

SECTION 10 28 00 - TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:
   1. Toilet and bath accessories.

B. Related Sections include the following:
   1. Division 10 Section "Toilet Compartments" for compartments and screens.

1.03 SUBMITTALS

A. Product Data: Include construction details, material descriptions and thicknesses, dimensions, profiles, fastening and mounting methods, specified options, and finishes for each type of accessory specified.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required. Use designations indicated in the Toilet and Bath Accessory Schedule and room designations indicated on Drawings in product schedule.

1.04 QUALITY ASSURANCE

A. Source Limitations: Provide products of same manufacturer for each type of accessory unit and for units exposed to view in same areas, unless otherwise approved by Architect.

B. Product Options: Accessory requirements, including those for materials, finishes, dimensions, capacities, and performance, are established by specific products indicated in the Toilet and Bath Accessory Schedule.
   1. Other manufacturers' products with equal characteristics may be considered. See Division 1 Section "Substitutions."
   2. Do not modify aesthetic effects, as judged solely by Architect, except with Architect's approval. Where modifications are proposed, submit comprehensive explanatory data to Architect for review.

1.05 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by disabled persons, proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.06 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall

be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Manufacturer's Mirror Warranty: Written warranty, executed by mirror manufacturer agreeing to replace mirrors that develop visible silver spoilage defects within minimum warranty period indicated.
   1. Minimum Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Bobrick Washroom Equipment, Inc. (Model numbers indicated)

B. American Specialities, Inc

C. Bradley Corporation

2.02 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, with No. 4 finish (satin), in 0.0312-inch (0.8-mm) minimum nominal thickness, unless otherwise indicated.

B. Brass: ASTM B 19, leaded and unleaded flat products; ASTM B 16 (ASTM B 16M), rods, shapes, forgings, and flat products with finished edges; ASTM B 30, castings.

C. Sheet Steel: ASTM A 366/A 366M, cold rolled, commercial quality, 0.0359-inch (0.9-mm) minimum nominal thickness; surface preparation and metal pretreatment as required for applied finish.

D. Galvanized Steel Sheet: ASTM A 653/A 653M, G60 (Z180).

E. Chromium Plating: ASTM B 456, Service Condition Number SC 2 (moderate service), nickel plus chromium electrodeposited on base metal.

F. Baked-Enamel Finish: Factory-applied, gloss-white, baked-acrylic-enamel coating.

G. Mirror Glass: ASTM C 1036, Type I, Class 1, Quality q2, nominal 6.0 mm thick, with silvering, electroplated copper coating, and protective organic coating complying with FS DD-M-411.

H. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

I. Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed.

2.03 FABRICATION

A. General: One, maximum 1-1/2-inch- (38-mm-) diameter, unobtrusive stamped manufacturer logo, as approved by Architect, is permitted on exposed face of accessories. On interior surface not exposed to view or back surface of each accessory, provide printed, waterproof label or stamped nameplate indicating manufacturer's name and product model number.

B. General: Names or labels are not permitted on exposed faces of accessories. On interior surface not exposed to view or on back surface of each accessory, provide printed, waterproof label or stamped nameplate indicating manufacturer's name and product model number.

C. Surface-Mounted Toilet Accessories: Unless otherwise indicated, fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with continuous stainless-steel hinge. Provide concealed anchorage where possible.

D. Recessed Toilet Accessories: Unless otherwise indicated, fabricate units of all-welded construction, without mitered corners. Hang doors and access panels with full-length, stainless-steel hinge. Provide anchorage that is fully concealed when unit is closed.

E. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.01 INSTALLATION

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

B. Secure mirrors to walls in concealed, tamper-resistant manner with special hangers, toggle bolts, or screws. Set units level, plumb, and square at locations indicated, according to manufacturer's written instructions for substrate indicated.

C. Install grab bars to withstand a downward load of at least 250 lbf (1112 N), when tested according to method in ASTM F 446.

3.02 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

3.03 TOILET AND BATH ACCESSORY SCHEDULE

A. Recessed Paper Towel Dispenser & Waste Receptacle, Bobrick B-369

B. Grab Bars, B-6806:
1. Stainless-Steel Nominal Thickness: Minimum 0.05 inch (1.3 mm).
2. Mounting: Concealed with manufacturer's standard flanges and anchors.
3. Gripping Surfaces: Manufacturer's standard slip-resistant texture.
4. Outside Diameter: 1-1/2 inches (38 mm) for heavy-duty applications.

C. Mop and Broom Holder, B-239 (1 per ea Janitor Room):
1. Mop and Broom Holder with Utility Shelf: 36-inch- (914-mm-) long unit fabricated of minimum nominal 0.05-inch- (1.3-mm-) thick stainless steel with shelf; support brackets for wall mounting; three hooks for wiping rags; four spring-loaded, rubber

hat, cam-type, mop/broom holders mounted on front of shelf; and approximately 1/4-inch- (6-mm-) diameter, stainless-steel rod suspended beneath shelf for drying rags.

D. Toilet Tissue Dispenser with Storage for Extra Roll, Bobrick B-6637 (1 per ea. toilet stall)

E. Recessed Toilet Seat Cover Dispenser, Bobrick B-301(1 per ea. toilet stall)

F. Recessed Sanitary Napkin Receptacle, Bobrick B-353 (1 per ea. women's toilet stall & public toilet stall)

G. Soap Dispenser, Bobrick, B-8221 (1 per ea. lavatory basin)

H. Mirror, 18"x 30", B-2908 (1 per ea. Lavatory)

I. Mirror, 48" x full width

J. Robe/Towel hooks, Bobrick, B-672

K. Stainless steel shelf, Bobrick, B-295x16

L. Reversable Folding Shower Seat, Bobrick B-5181

M. Recessed Heavy-Duty Soap Dish, Bobrick B-4380

N. Shower Curtain hooks and Curtain Rod, Bobrick B-204-2 & B-204-1& B-6107

END OF SECTION

SECTION 11 11 11 – VEHICAL EXHAUST REMOVAL SYSTEM

1. General:

1.01 **SCOPE.**

A. The bidder shall provide all labor, materials, and equipment necessary, to put in working operation a complete system to remove both diesel and automotive exhaust gases, and particulate of operating vehicles within the confines of specified fire station(s). All necessary controls, fan, ductwork, labor and all other equipment and materials specified shall be part of the bidders work.

B. All items of equipment and materials described in these specifications are to be furnished installed and placed into proper operating condition in accordance with good practice and manufacturer's written or published instructions.

C. All workmanship and materials shall be in accordance with applicable codes and regulations. ie, SMACNA, BOCA, NEC, ASTM, UBC, UMC, NFPA, AMCA and IMC. Such codes and regulations are to be considered part of these specifications.

D. The bidder shall warranty all materials, equipment and workmanship for a period of one (1) year from the date of final acceptance of the completed job, against original defects of material and workmanship, improper or insufficient maintenance, excessive wear and deterioration. Repairs shall be made at the bidders expense.

E. Bidder shall install a complete automatic disconnect Diesel Exhaust Removal System, that addresses the problem of diesel fumes in the fire department station house that will not interfere with normal day-to-day operations. The system shall be a **Plymovent VSRX Rail** type system that has the following performance criteria.

(1) The exhaust removal system must provide approximately 100% complete evacuation of all diesel fumes at the source from start up to exit of the apparatus from the fire station. The diesel exhaust removal system shall be capable of reaching to the undercarriage of the vehicle tailpipe located anywhere from 10 to 90 feet away from the exiting door. The system must be able to accommodate drive through and back in bays to meet all the needs of the fire department.

(2) The system must not affect personnel boarding the apparatus. Hose loops shall not hang any lower then seven feet from the bay floor. The hose assembly shall not touch or drag on the bay floor.

(3) The exhaust system shall not block doorways, exits, and aisles in the apparatus bay, which could endanger the welfare of fire personnel visitors.

(4) To protect the apparatus electrical system from any possible damage, the system bid shall not incorporate any type of electromagnetic device that requires the apparatus to be utilized as and electrical ground for the systems operation.

(5) Due to the harmful effects of diesel exhaust, the system must be designed and capable of capturing approximately 100% of the exhaust gas and particulate even in the event of a complete power failure. The system shall not detach itself from the apparatus for any reason during a power failure other then normal exiting of the apparatus bay. **No exception to this requirement will be allowed.**

(6) Connection of the system to the vehicle must be made from a standing position. **No exception to this requirement will be allowed.**

(7) Manufacturer must be I.S.O. 9001 certified

1.02 **STANDARD PRODUCTS:** Equipment and materials provided for the system installation shall be a standard product of manufacturer's currently engaged in the manufacturing of automatic vehicle exhaust removal systems. Where the requirement calls for a packaged exhaust system to be provided, all items shall be the product of the manufacturer.

1.03 **QUALITY ASSURANCE:** All workmanship, manufacturing procedures, airflow design, and materials shall be performance guaranteed. If any findings or test studies reveal improper materials, defective components or inadequate performance as outlined in the performance/technical specifications, the bidder shall remove and replace the materials in question.

1.04 **EQUIPMENT WARRANTY:** The bidder shall guarantee all materials, equipment and workmanship for a period of one (1) year from the date of the final acceptance of the completed job against original defects of material and workmanship, or excessive wear or deterioration. Defects shall be made good at the bidders expense with no cost or obligation to the Owner.

1.05 **PRODUCT DELIVERY, STORAGE, AND HANDLING:** The bidder shall be solely responsible for the delivery, storage, and handling of all products. Any equipment placed in storage shall be protected from weather, humidity, temperature variations, dirt, dust, or other contaminants.

1.06 **BIDDER QUALIFICATIONS:** Bids will only be accepted from companies that have an established reputation in the field of manufacturing and installing Diesel Exhaust Removal Systems. The bidder must be established in the business of Diesel Exhaust Removal Systems for a minimum of no less then eight- (8) years. **Bidder shall show proof that their system has been field tested and proven by supplying a list of not less then 100 fire department references (seven within the state the municipality is going to bid) to include a phone number and contact name.**

2. PRODUCTS:

2.01 **MANUFACTURER**

A. **PlymoVent Corporation**/Plymovent Industrial Ventilation Systems or approved equal.
115 Melrich Road
Cranbury, New Jersey 08512
USA
Toll Free: (800) 644-0911
FAX: (609) 655-0569
WEB: info@plymoventusa.com

B. **LOCAL CONTACT**
Air Exchange, Inc.
495-A Edison Ct.
Fairfield, CA 94534
Contact Name: Chris Koss
Toll Free: (800) 300-2945
Email: info@airexchange.com
Email: ckoss@airexchange.com

2.02 **AIR MOVING DEVICES:**

A. **Centrifugal Fans:**The fan shall be a direct drive centrifugal type, high pressure, single width, single inlet as required or indicated. Impeller wheels shall be of a radial design for high static pressure performance. Impeller wheels shall be spark resistance and made of aluminum material to prevent static electricity build up. The impeller shall be dynamically and static balanced, and of the non-overloading type to provide maximum efficiency while achieving quiet, vibration-free operation.

The fan motor and assembly shall be mounted on a steel frame for durability in any type of weather conditions. The base shall have four (4) pre punched openings at bottom of fan base for field attachment to either an exterior wall or roof structure.

B. **Fan motor and bearing:**All 1 to 10 horsepower motors shall be totally enclosed fan cooled (TEFC). The bearings shall be self-aligned; ball bearing type permanently sealed and lubricated. Fan shafts shall be steel and rotate in a non-sparking TEFLON seal to prevent hot gases coming in contact with the motor bearings. The exhaust discharge outlet shall be in compliance with ACGIH recommendations and EPA requirements (min. of 40 ” above roofline). Air intakes, windows, cascade systems, prevailing currents, communication equipment and building aesthetics shall be considered in the final location of the fan. Silencers shall be provided when fan sound decibels exceed 64 Dba.

C. **Performance:**The Fan Capacity shall be sized as such as to deliver the required CFM at each hose drop the vehicle engine exhaust (based on an airtight connection at tailpipe), lengths of ductworks, elbows, branches, shut down. wyes, etc. which accumulate the static pressure at the field inlet. The manufacturer’s provided fan(s) shall be performance guaranteed.

D. **Location:**The fan shall be located on the outside of the fire station as far away from any living quarters as possible so that firefighters would not be disturbed by the system activation.

2.03 ELECTRICAL CONTROLLERS

A. **Controller type:**The controller shall be manufactured and delivered as an Operating System with one series controller manufactured by the bidder or An equal to the specifications to follow.

B. **Electrical controllers:**The electrical controller offered shall be approved by Underwriters Laboratories (UL) as a complete electrical system for enclosed industrial control panels. **No exceptions.**

(1) Electrical controllers shall be UL listed/approved and manufactured in accordance with Underwriters Laboratories standard UL-508 enclosed industrial control panels. Enclosures shall be NEMA 12 rated and UL listed as Type 12. The electrical enclosure shall be provided and mounted in an electrical enclosure to restrict access to internal components of controller by only authorized entry.

C. **Electrical Contactors:**Contactors shall be Allen Bradley Industrial Electrical Contactors, provided with the appropriate adjustable overload relays to meet the proper full load amperage of motor that is outlined in these specifications. The contactor shall conform to the following standards: BS-5424, VDE0660, and be approved by UL Certification as an approved component.

D. **Control Transformer:** Shall be UL listed industrial control circuit transformer with primary and secondary fuse blocks. Transformer shall be provided with multi-tap primary 208V through 480V, AC, and 24V through 120V secondary.

E. **Electrical Timer:** Shall be solid state five- (5) minute adjustable timer. The operating logic shall complete this cycle. Input voltage shall be applied to the timer at all times. Upon closure of a normally open isolated start switch, the load energizes and remains energized as long as the switch is closed. When the start switch opens, the timing cycle shall start. At the end of the preset time delay, the load de-energizes and the timer is ready for a new timing cycle. Timer shall be a UL recognized component under file number E65038.

F. **Engine Start Switch:** Shall be of an engine pressure sensing type, capable of recognizing the output pressure of any type of motor vehicle exhaust. The electrical contact shall be dry type or not to exceed 24V.

G. **Electrical Wiring:** Shall be run in wire channel to allow for easier identification of wiring circuit and appearance. All wiring circuitry shall meet UL listed for proper bending radiuses and terminations.

H. **Electrical Terminal Block:** Shall be 600 V, UL rated and recognized. It shall provide individual connection points for remote controls, power and motor connections.

I. **Electrical Wiring Schematic:** Shall be provided with each electrical control box supplied. Wiring schematic shall show internal circuitry as well as all primary and secondary connections to the controller.

2.04 DUCTWORK SYSTEM:

A. **Ductwork type and materials:** Shall be UMC class 2 or SMACNA class 11 product conveying. It must meet or exceed criteria for construction and performance as outlined in Round Industrial Duct Construction Standards, SMACNA. Materials of construction unless otherwise specified for all ductwork and fittings shall be a minimum G-90 galvanized sheet metal in accordance with ASTM-A525 and A527. Only when specified, type 304 stainless steel in accordance with ASTM A240 shall be provided.

B. **Ductwork sizing and gauges:** All ductwork subject to positive or negative pressure shall be of round, spiral pipe construction, with the range of available sizes not to exceed 20 inches in diameter. Duct gauge shall depend on diameter and a minimum operating pressure of 8 inches water gauge. Acceptable gauge and reinforcement requirements shall be in accordance to the following. Inner duct diameter 4" - 13" dia. shall be 26 gauge standard spiral pipe and 14" - 20" dia. shall be 24-gauge standard spiral pipe.

C. **Ductwork Fittings:** All exhaust fittings shall be round and have a wall thickness 2 gauges (one even gauge number) heavier than the lightest allowable gauge of the downstream section of duct to which they are connected. Air duct branch entrances shall be fabricated fittings or fabricated duct/tap assemblies. Fittings shall be constructed so that air stream converge at angles no greater then 45 degree. All seams shall be spot welded and if necessary internally sealed to insure airtightness. Tapered body fittings shall be used manifold. **No exceptions.**

D. **Ductwork Design Velocities:** Shall be a minimum of 3000 feet/minute transport velocity at 275 cubic feet/per minute volume in metal ductwork at riser clamp which is the standard for design.

E. **External Ductwork:** Shall be sized for the exact inlet and outlet of the exhaust fan blower. If the fire station is exposed to unusual inclement weather, unusual levels of acid rain or is within 3 miles of salt water, stainless steel shall considered for all exterior duct work components. An exhaust rain cap shall be supplied and manufactured in accordance with EPA standard for free draft rain cap requirements. Included as an integral part of this rain cap shall be a back draft damper to provide protection from rain and other inclement weather or air.

F. **Exhaust Penetrations:** To protect the fire departments best interest ductwork shall only penetrate exterior walls rather than a roof penetration. In all cases when making a wall penetration through masonry or concrete walls it shall be done by the use of a professional core-drilling machine. The core drilling shall be properly sized to reduce the diameter of the opening to the smallest possible size. Only after all possible avenues for wall penetration are exhausted, shall the roof penetration be accepted. The original roofing contractor shall perform the work if possible to insure any warranties on the existing roof are not voided. If the original roofing contractor can not be notified a licensed roofing contractor shall be used.

2.05 VEHICLE EXHAUST REMOVAL SYSTEM EQUIPMENT:

A. **Scope of System Operation:** The vehicle exhaust removal system shall capture approximately 100 % of the exhaust emissions directly at the tailpipe of the vehicle and exhaust those emissions to a specified area safely outside the building. The operating controller shall be designed to complete this cycle. A pneumatic operated collection nozzle shall be connected to the motor vehicle's exhaust tailpipe, when the vehicle is started by the driver, the exhaust fan will automatically energize and vent the toxic gases directly to the outside of the building. This automatic feature shall be achieved by means of a pressure sensor located inside the exhaust ducting; this pressure sensor shall sense the engines output pressure upon the first stroke of the engine piston and energize the fan starter. The automatic controller shall use an adjustable timer to keep the contactors energized for a designated period of time. Should the operating vehicle not exit the station within the designated preset time period the manual run button on the OS-3 control panel must be engaged, this will keep the fan running while the vehicle is running and must be turned off manually via stop button on OS-3 control panel.

The pneumatic connection device shall stay connected to the vehicle tailpipe as it travels to the exit door in a pre-engineered rail system. The rail shall be securely attached to the building structure and supports a flexible hose assembly that moves with vehicle inside the station. As the vehicle nears the exit door, the pneumatic nozzle connection located at the tailpipe shall tension release automatically therefore releasing the nozzle from the tailpipe. This shall be accomplished by means of uncoupling valve, balancer and end stop strategically located on the track/rail. After the system releases the vehicle tailpipe at the door, it shall retract passively and smoothly into a convenient storage position. When the vehicle returns to the station, a system operator manually pulls the flexible hose assembly to the entrance door. The system operator holds the pneumatic connection device approximately 18" from the floor and at the door threshold. The system operator, without bending over, attaches the pneumatic connection device just inside the door threshold as the vehicle enters the station, at which time the exhaust fan motor energizes. The vehicle driver momentarily stops the vehicle when the tailpipe is just at the door threshold (a backup man will notify the driver when it is time to stop the vehicle).The system operator, standing straight up shall slide the connection device up against a flanged adapter attached to the vehicle tailpipe. The cycle is completed as the exhaust fan starts and vents the toxic gases with the magnetic connection nozzle firmly attached to the vehicle exhaust pipe. The vehicle then proceeds to its designated resting position.

B. **VSRX Rail Material:** Model: VSRX-75. Shall be constructed of a one-piece continuous extruded aluminum rail in a minimum length of 10 feet (5.79 m). Construction Profile: Rectangular profile, rail height of 10 inches (254 mm) including the rubber seals, rail thickness of 0.20 inch (5 mm), width of 8-½ inches (216 mm) ID. Bottom Portion of Rail: Continuous slots to accept a rubber seal. Rubber Seals: Fitted into each side of the rail and shall join in the middle. Rail Material: Aircraft aluminum alloy Type AA-6063 (ASTM B209/B209M). Rail: Extruded as a one piece design unit to maximize the structural integrity of the rail and to minimize joints which may add to possible leakage of dangerous exhaust gases.

C. **Support Legs:** Support legs shall be manufactured and provided by the supplier of the primary exhaust removal system. (Equipment Manufacturer). This is to ensure that the unit is installed as a complete system including the mounting hardware. Support legs are 2" x 2" aluminum cut to proper lengths during installation work. Adjustable mounting bracket kit consists of two brackets to be thru bolted to leg stock. Side bracket kit comes with clamp for leg stock and two side braces for lateral and longitude bracing. Approximately one support left every ten feet. The angle shall be completely adjustable to the leg support and mounted perpendicular and parallel to direction of the track. The typical support angle shall be 45 degrees from the center line of the factory provided support leg.

D. **Hydraulic Brake System:** The brake shall be incorporated into the end cap of the suction rail profile. The hydraulic brake system must incorporate an adjustable hydraulic shock, capable of reducing the forward impact of 1 to 4 suction trolleys, which may be installed now or in the future to the exhaust rail system. The hydraulic shock shall be capable of reducing to a full stop the trolley or trolleys in less than 6", without physical damage to either the rail profile or trolley that it is stopping. The hydraulic shock must come in contact with a rubber bumper that is provided on the trolley assembly. Metal to plastic or metal to metal contact is not acceptable.

E. **Rail Splicing Joint:** The splice joint shall be formed aluminum extrusion equal to the internal diameter of the suction rail profile. The splice shall have a wall thickness of no less than .190" in thickness and a length of no less than 8" from end to end. The rail splicing shall be safely secured by no less that 12- 3/8" bolts, nuts and lock washers. Each bolt shall pass through the exterior of the rail profile and splicing joint and be secured on the inside by a lock washer and nut. Self-tapping bolts or screws are not acceptable.

F. **Middle Rail Duct Connection:** The rail duct connection shall be rectangular to a 6" diameter round transition fitting fabricated from 24 gauge galvanized steel.

G. **Trolley Assembly:** Trolley Assembly shall be a gantry type trolley with sealed bearing loaded wheels designed to roll inside the internal rail profile flange. The trolley chasses shall be galvanized steel epoxy coated with a black finish. The chassis shall be fitted with a tapered cone. The cone shall be fitted with independent friction wheels, which shall minimize resistance between the cone and the rubber sealing lips. The exhaust cone transition shall be a tapered slot design, which shall fit inside the suction rail profile. The tapered slot shall be equal or exceed in area the diameter of exhaust ventilation hose, which it is attached to. The trolley assembly shall be equipped with rubber impact bumpers at both the front and rear of the trolley assembly. There shall be a system balancer assembly provided to aid in the delivery of the hose to the exit door. The balancer assembly shall be a self-adjusting weight spring tension balancer with a lifting capacity of no less than 31 lbs. The balancer shall have a minimum diameter steel cable of .080 and have a safety link connection. The system supplier shall manufacture both

the balancer and the trolley assemblies for the purpose of conveying the flexible hose to the door exit for automatic release of the pneumatic collection nozzle. Only a stainless steel balancer cable will be accepted. **No exceptions.**

H. **Regulator Assembly:** The regulator assembly shall be constructed of cast aluminum and refinished with black epoxy coating for durability. The regulator shall safely operate with an in-put pressure of 0 - 200 psi; the output pressure shall be preset at 15 psi. The regulator shall be attached to each trolley chassis to allow for independent adjustment of each pneumatic nozzle. The regulator shall also be provided with needle type adjustment gauge that is clearly marked with the proper operating range of system.

I. **Uncoupling Valve Assembly:** Shall be provided to activate the release of the pneumatic nozzle connection located on vehicles exhaust pipe. The valve shall be a whisker type that shall provide a single direction action and affixed to a mounting bracket directly onto the trolley chassis. The valve shall be activated when the whisker switch comes in contact with a disconnect plate located on the side of the rail profile. The disconnect plate shall provide activation for the uncoupling valve switch mounted on the suction trolley chassis. The disconnect plate shall be capable of being mounted anywhere on the outside of the rail in a manner that slows for easy adjustment. No holes shall be drilled into the rail for the mounting of the disconnect plate. One disconnect plate shall be provided for each trolley that is provided, to allow for independent adjustment of exit speeds.

J. **Upper Flexible Hose:** Hose shall be flexible exhaust hose manufactured for the sole purpose of venting high temperature exhaust gases, which are produced by internal combustion engines. The flexible hose shall be designed strictly for the harsh environment of rapid response and auto-release of a vehicle exhaust tailpipe. Hose shall range from 3” - 5” diameters with varying lengths depending on the system length required ranging from 20 - 43 feet without joining or splicing connections.

Hose material shall be high temperature synthetic rubber impregnated into a high temperature laminated fabric with a minimum overlapping thickness of 2 7/16”. This construction of hose must be capable of operating at continuous temperatures f 400 degrees F and intermittent temperatures of 500 degrees F such as are experienced when pump checks are performed inside the station. Independent testing by a recognized UL laboratory must accompany this bid as proof of performance claim. Wire Helix shall be bound and protected in laminations of hose winding. This shall be accomplished in a fashion, which eliminates any possibility of personnel coming in contact with an exposed hot metal helix. The hose shall further protect the internal wire helix from heat buildup and in turn add increased visibility to personnel. Wear strip shall be 9/16” wide and be provided as a safety yellow color. The bend radius of the high temperature hose shall be no lesser then 1.5 times the diameter of hose to insure that hot gases be restricted as they pass through the system.

K. **Lower Hose Assembly:** Shall be a rigid 3”-5" diameter by 2 foot long section of yellow and black hose identical in appearance to the upper hose assembly. Lower hose shall support the pneumatic connection nozzle and chrome reducing elbow in a rigid fashion as to allow for the operator to place hose collection nozzle onto the tailpipe without bending over. Lower hose is the only section of hose which shall disconnect from the upper hose assembly and act as a safety disconnect in the unlikely event the nozzle gets entangled.

L. **Safety Disconnect Coupling:** A coupling shall be incorporated in the design of the system enabling the lower two foot hose assembly to separate from the upper hose assembly thus reducing the possible chance of damage to system, in the unlikely event the exhaust connection nozzle assembly may become entangled. This device shall

consist of two spun aluminum collars connected by an ergonomic round handle. The release tension of this device shall separate the two at no greater than 88 Lb. **This is considered a safety requirement and any system bid must incorporate a safety disconnect. No Exceptions.**

M. **Collection Nozzle Assembly:** The nozzle shall provide an substantially air tight seal around exhaust tail pipe when connected thus allowing for 100% source capture. The seal shall not allow for escape of life threatening exhaust gases, which may be present during the following conditions. If vehicle's engine is accelerated above normal idle resulting in an exhaust velocity greater than 5000 feet per minute or in the event that the output velocity or CFM of the exhaust exceeds the manufacturers normal capture velocity or CFM of exhaust system. The Nozzle shall automatically adjust its internal orifice to accept any tail pipe ranging from one inch through six-inch diameter. The bidder of the nozzle shall offer, if required, both maximum diameter nozzles ranging from 4.75" diameter to 8.25" diameter. The nozzle pressure shall not exceed 15 psi. when connected to the vehicles tailpipe. Nozzle construction shall be high temperature synthetic rubber, vulcanized to a high temperature synthetic fabric. A NOMEX inner liner shall be provided for the primary temperature source at the tailpipe and also act as a friction barrier. The chrome-reducing elbow that connects to the connection nozzle shall be fabricated using continuous welded construction. This important feature eliminates the escape of any potentially lethal exhaust gases and must provide for a smooth air flow transition from connection nozzle into the high temperature flexible hose.

The angle of transition shall be no less than or greater than 67 degrees from the center line of reducer. The chrome-reducer shall incorporate a primary expanded metal debris screen, which is permanently affixed by welded seams to the inside opening of exhaust fitting. Since this item is a point of safety for both personnel and the system itself, no exception will be tolerated for this point.

N. **Hose Saddle:** A hose suspension saddle shall be a steel elbow specifically manufactured for the sole purpose of suspending high temperature flexible hose. The design of the saddle shall smoothly transition the direction of the hose during its travel along the track. Securing clamps shall be provided including a link fastener, for the purpose of mounting it to the balancer safety link.

O. **Special Features:** The system must be designed to expand for future apparatus to a tandem vehicle arrangement (one vehicle behind the other) by adding to the proposed system. Systems that require replacement of the existing system or major components to meet a tandem vehicle arrangement shall not be accepted. Overall system design and performance shall be for both back in and drive-through configurations when applicable, this assures door to door coverage and collection of dangerous exhaust gases from the point of connection at the doorway.

P. **Vehicle Tailpipe Modification:** The bidder shall supply a drawing for the precise modification procedure for the vehicles to attach to the exhaust removal system. The modification shall vent the exhaust gases at a 90-degree angle on the passenger side of vehicle. Tailpipe modifications requiring a 45-degree angle of exhaust venting shall not be acceptable, so to prevent exhaust blow back into station after the auto-release system disengages from the tailpipe. A flange shall be provided and installed by the bidder as a precisely located stopping point for the collection nozzle.

3. EXECUTION:

3.01 **TRAINING:** The bidder or authorized approved personnel, shall provide training to fire department personnel in the daily use and maintenance of the vehicle exhaust removal

system that has been installed and specified herein. The fire department shall be notified at least 2 days prior to the date scheduled for the training course. Training shall be for all personnel involved with the operation of the exhaust removal system to include all shifts required to man the particular facility.

The Training session, shall be performed in person by a recognized representative of the manufacturer of the exhaust removal system, in addition a training video shall be provided to the fire department.

END OF SECTION

SECTION 12 24 13 – ROLL DOWN WINDOW SHADES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Manually operated sunscreen roller shades.

1.2 RELATED SECTIONS

A. Section 06100 - Rough Carpentry: Wood blocking and grounds for mounting roller shades and accessories.

B. Section 09260 - Gypsum Board Assemblies: Coordination with gypsum board assemblies for installation of shade pockets, closures and related accessories.

1.3 REFERENCES

A. ASTM G 21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

B. NFPA 70 - National Electrical Code.

C. NFPA 701-99 - Fire Tests for Flame-Resistant Textiles and Films.

1.4 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.

2. Styles, material descriptions, dimensions of individual components, profiles, features, finishes and operating instructions.

3. Storage and handling requirements and recommendations.

4. Mounting details and installation methods.

5. Typical wiring diagrams including integration of motor controllers with building management system, audiovisual and lighting control systems as applicable.

B. Shop Drawings: Plans, elevations, sections, product details, installation details, operational clearances, wiring diagrams and relationship to adjacent work.

C. Window Treatment Schedule: For all roller shades. Use same room designations as indicated on the Drawings and include opening sizes and key to typical mounting details.

D. Selection Samples: For each finish product specified, one set of shade cloth options and aluminum finish color samples representing manufacturer's full range of available colors and patterns.

E. Maintenance Data: Methods for maintaining roller shades, precautions regarding cleaning materials and methods, instructions for operating hardware and controls.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Obtain roller shades through one source from a single manufacturer with a minimum of ten years experience in manufacturing products comparable to those specified in this section.

B. Installer Qualifications: Installer trained and certified by the manufacturer with a minimum of three years experience in installing products comparable to those specified in this section.

C. Fire-Test-Response Characteristics: Passes NFPA 701-99 small and large-scale vertical burn. Materials tested shall be identical to products proposed for use.

D. Electrical Components: NFPA Article 100 listed and labeled by either UL or ETL or other testing agency acceptable to authorities having jurisdiction, marked for intended use, and tested as a system. Individual testing of components will not be acceptable in lieu of system testing.

E. Anti-Microbial Characteristics: 'No Growth' per ASTM G 21 results for fungi ATCC9642, ATCC 9644, ATCC9645.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver shades in factory-labeled packages, marked with manufacturer and product name, fire-test-response characteristics, and location of installation using same room designations indicated on Drawings and in the Window Treatment Schedule.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Install roller shades after finish work including painting is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.8 WARRANTY

A. Roller Shade Hardware, Chain and Shadecloth Manufacturer's standard non-depreciating twenty-five year limited warranty.

B. Roller Shade Motors and Motor Control Systems: Manufacturer's standard non-depreciating five-year warranty.

C. Roller Shade Installation: One year from date of Substantial Completion, not including scaffolding, lifts or other means to reach inaccessible areas.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: MechoShade Systems, Inc. or approved equal

B. Substitutions: Substitutions shall be submitted in writing and Architect shall have final authority of acceptance.

2.2 APPLICATIONS/SCOPE

A. Roller Shade Schedule:

Provide window coverings at all interior & exterior window locations at windows with a

head height of 14’ and below:

1. Shade Type 1: Manual operating, chain drive, sunscreen roller shades in all exterior windows of rooms and spaces shown on the Drawings.

2.3 SHADE CLOTH

A. Visually Transparent Single-Fabric Shadecloth: MechoShade Systems, Inc., ThermoVeil group, single thickness non-raveling 0.030-inch (0.762 mm) thick vinyl fabric, woven from 0.018-inch (0.457 mm) diameter extruded vinyl yarn comprising of 21 percent polyester and 79 percent reinforced vinyl, in colors selected from manufacturer's full range.

1. Dense Basket Weave: "1500 series", 3 percent open, 2 by 2 dense basket-weave pattern

a. Color: Selected from manufacturer's full range of colors.

b. At Exterior Windows

B. Visually Transparent Single-Fabric Shadecloth: MechoShade Systems, Inc., EuroTwill "6000" Series: 0.010 diameter (0.254 mm) non-raveling vinyl/polyester yarn, fabric thickness 0.025 inches (0.635 mm).

1. Extra Dense Twill Weave "6000" series, 2-3 percent open.

a. Color: Selected from manufacturer's full range of colors.

b. At Interior Windows

2.4 SHADE BAND

A. Shade Bands: Construction of shade band includes the fabric, the hem weight, hem-pocket, shade roller tube, and the attachment of the shade band to the roller tube. Sewn hems and open hem pockets are not acceptable.

1. Hem Pockets and Hem Weights: Fabric hem pocket with RF-welded seams (including welded ends) and concealed hem weights. Hem weights shall be of appropriate size and weight for shade band. Hem weight shall be continuous inside a sealed hem pocket. Hem pocket construction and hem weights shall be similar, for all shades within one room.

2. Shade band and Shade Roller Attachment:

a. Use extruded aluminum shade roller tube of a diameter and wall thickness required to support shade fabric without excessive deflection. Roller tubes less than 1.55 inch (39.37 mm) in diameter for manual shades, and less than 2.55 inches (64.77 mm) for motorize shades are not acceptable.

b. Provide for positive mechanical engagement with drive / brake mechanism.

c. Provide for positive mechanical attachment of shade band to roller tube; shade band shall be made removable / replaceable with a "snap-on" snap-off" spline mounting, without having to remove shade roller from shade brackets.

d. Mounting spline shall not require use of adhesives, adhesive tapes, staples, and/or rivets.

e. Any method of attaching shade band to roller tube that requires the use of: adhesive, adhesive tapes, staples, and/or rivets are not acceptable.

2.5 SHADE FABRICATION

A. Fabricate units to completely fill existing openings from head to sill and jamb-to-jamb, unless specifically indicated otherwise.

B. Fabricate shadecloth to hang flat without buckling or distortion. Fabricate with heat-sealed trimmed edges to hang straight without curling or raveling. Fabricate unguided shadecloth to roll true and straight without shifting sideways more than 1/8 inch (3.18 mm) in either direction per 8 feet (2438 mm) of shade height due to warp distortion or weave design. Fabricate hem as follows:

1. Bottom hem weights.

C. Provide battens in standard shades as required to assure proper tracking and uniform rolling of the shadebands. Contractor shall be responsible for assuring the width-to-height (W:H) ratios shall not exceed manufacturer's standards or, in absence of such standards, shall be responsible for establishing appropriate standards to assure proper tracking and rolling of the shadecloth within specified standards. Battens shall be roll-formed stainless steel or tempered steel, as required.

D. For railroaded shadebands, provide seams in railroaded multi-width shadebands as required to meet size requirements and in accordance with seam alignment as acceptable to Architect. Seams shall be properly located. Furnish battens in place of plain seams when the width, height, or weight of the shade exceeds manufacturer's standards. In absence of such standards, assure proper use of seams or battens as required to, and assure the proper tracking of the railroaded multi-width shadebands.

E. Provide battens for railroaded shades when width-to-height (W:H) ratios meet or exceed manufacturer's standards. In absence of manufacturer's standards, be responsible for proper use and placement of battens to assure proper tracking and roll of shadebands.

2.6 COMPONENTS

A. Access and Material Requirements:

1. Provide shade hardware allowing for the removal of shade roller tube from brackets without removing hardware from opening and without requiring end or center supports to be removed.

2. Provide shade hardware that allows for removal and re-mounting of the shade bands without having to remove the shade tube, drive or operating support brackets.

3. Use only Delrin engineered plastics by DuPont for all plastic components of shade hardware. Styrene based plastics, and /or polyester, or reinforced polyester will not be acceptable.

B. Manual Operated Chain Drive Hardware and Brackets:

1. Provide for universal, regular and offset drive capacity, allowing drive chain to fall at front, rear or non-offset for all shade drive end brackets. Universal offset shall be adjustable for future change.

2. Provide hardware capable for installation of a removable fascia, for both regular and/or reverse roll, which shall be installed without exposed fastening devices of any kind.

3. Provide shade hardware system that allows for removable regular and/or reverse roll fascias to be mounted continuously across two or more shade bands without requiring exposed fasteners of any kind.

4. Provide shade hardware system that allows for operation of multiple shade bands (multi-banded shades) by a single chain operator, subject to manufacturer's design criteria. Connectors shall be offset to assure alignment from the first to the last shade band.

5. Provide shade hardware system that allows multi-banded manually operated shades to be capable of smooth operation when the axis is offset a maximum of 6 degrees on each side of the plane perpendicular to the radial line of the curve, for a 12 degrees total offset.

6. Provide positive mechanical engagement of drive mechanism to shade roller tube. Friction fit connectors for drive mechanism connection to shade roller tube are not acceptable

7. Provide shade hardware constructed of minimum 1/8-inch (3.18 mm) thick plated steel or heavier as required to support 150 percent of the full weight of each shade.

2.7 ACCESSORIES

A. Roller Shade Pocket for recessed mounting in acoustical tile, or drywall ceilings as indicated on the Drawings

1. Provide either extruded aluminum and or formed steel shade pocket, sized to accommodate roller shades, with exposed extruded aluminum closure mount, tile support and removable closure panel to provide access to shades.

B. Fascia (for outside mount shades)

1. Continuous removable extruded aluminum fascia that attaches to shade mounting brackets without the use of adhesives, magnetic strips, or exposed fasteners.

2. Fascia shall be able to be installed across two or more shade bands in one piece.

3. Fascia shall fully conceal brackets, shade roller and fabric on the tube.

4. Provide bracket / fascia end caps where mounting conditions expose outside of roller shade brackets.

5. Notching of Fascia for manual chain shall not be acceptable.

a. Color: Selected from manufacturer's full range of colors.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install roller shades level, plumb, square, and true according to manufacturer's written instructions, and located so shade band is not closer than 2 inches (50 mm) to interior face of glass. Allow proper clearances for window operation hardware.

B. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

C. Clean roller shade surfaces after installation, according to manufacturer's written instructions.

D. Engage Installer to train Owner's maintenance personnel to adjust, operate and maintain roller shade systems.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 22 05 00 - BASIC MECHANICAL MATERIALS & METHODS

PART 1 - GENERAL

1.01 INCLUSIONS:

A. This section applies for all Division 22 and 23 sections. All conditions and materials are pertinent to the other sections as if repeated in those sections.

B. Furnish and install any incidental work not shown or specified which is necessary to provide a complete and workable system.

1.02 DRAWINGS:

A. Examine all Drawings prior to bidding of work and report any discrepancies in writing to the Architect.

B. Drawings showing location of equipment, piping, ductwork, etc., are diagrammatic and job conditions will not always permit their installation in the location shown. The Mechanical Drawings show the general arrangement of all piping, ductwork, equipment, etc., and shall be followed as closely as existing conditions, actual building construction and the work of other trades will permit. The Architectural and Structural Drawings shall be considered a part of the work insofar as these Drawings furnish the Contractor with information relating to design and construction of the building. Architectural Drawings shall take precedence over Mechanical Drawings. Because of the small scale of the Mechanical Drawing, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall investigate the structural and finish conditions affecting the work and shall arrange his work accordingly providing such fittings, valves and accessories as may be required to meet conditions. When job conditions do not permit installation of equipment, piping, ductwork, etc., in the locations shown, it shall be brought to the Architect's attention immediately and the relocation determined in a joint conference. Contractor will be held responsible for the relocation of any items without first obtaining the Architect's approval. Contractor shall remove and relocate such items at his own expense if so directed by the Architect.

C. Execute work mentioned in the Specifications and not shown on the Drawings, or vice versa, the same as if specifically mentioned in both.

1.03 CODES:

A. Provide all work and materials in full accordance with the latest rules and regulations of the California Code of Regulations (CCR), Title 21, Title 22, and Title 24, as applicable, Safety Orders of the Division of Industrial Safety, (Cal OSHA); the California Electric Code; the California Plumbing Code; the California Building Code; California Mechanical Code; State Fire Marshal; and other applicable laws or regulations. Nothing in these plans or specifications is to be construed to permit work not conforming to these codes. Furnish without extra charge, any additional material and labor required to comply with these rules and regulations.

B. Where material or equipment is specified to conform to standards such as American Society of Testing and Materials (ASTM), Underwriters' Laboratories, Inc., (UL), American National Standards Institute (ANSI) and the like, it shall be assumed that the most recent edition of the standard in effect at the time of bid shall be used.

1.04 FEES AND PERMITS:

A. Procure and pay for all permits and licenses required.

1.05 FRAMING, CUTTING AND PATCHING:

A. Special framing, recesses, chases and backing for work of this section, unless specified otherwise, is covered under other sections. Be responsible for proper placement of all pipe sleeves, hangers and supports and location and sizing of openings for work of this section.

1.06 SUBSTITUTIONS AND MATERIAL LIST:

A. Product names are used as standards of quality, items furnished as standard on specified equipment shall be furnished on all substituted equipment at no extra cost to the contract regardless of disposition of submittal data; other materials or methods shall not be used unless approved in writing by the Architect. The burden of proof as to the equality of any proposed material shall be upon the Contractor; Architect's decision is final. Only one request for substitution shall be considered for each item. Equipment capacities specified are minimum acceptable. Submittals will not be accepted until compliance with the requirements of Contract Documents has been confirmed by the Contractor.

B. Unless stipulated otherwise in General Conditions and Division 1, submit a list of 7 copies of materials for approval within 35 days after the award of the Contract. It shall be accompanied by shop drawings, pump performance curves, fan curves, and other pertinent data, showing the size and capacity of the proposed materials. All materials to be used, whether substitutions or not, shall be listed in the order in which they appear in the specifications.

C. Any mechanical, electrical, structural, or other changes required for the installation of any approved substituted equipment shall be made to the satisfaction of the Architect and without additional cost to the Owner. Approval by the Architect of the substituted equipment and/or dimensional drawings does not waive these requirements. Upon request, submit drawings of mechanical equipment spaces showing substituted equipment before installation.

D. Review of material shall not be construed as authorizing any deviations from the specifications unless the attention of the Architect has been directed to the specific deviations.

E. Furnish to the Project Representative, upon request, complete installation instructions on all materials and equipment before starting installation of same.

F. Submittals shall bear the specification reference or drawing location where they are specified. Submittals shall not be accepted in incomplete form. Submittals shall be organized into booklets for each specification section and submitted in indexed loose leaf binders with notation when it is a deviation from the specifications.

G. Have fire damper installation instructions available at the site during construction for use by the inspector.

1.07 SITE CONDITIONS:

A. Information on the drawings relative to existing conditions is approximate only. Deviations found necessary during progress of construction to conform to actual conditions, as approved by the Architect, shall be made without additional cost to the Owner. The Contractor shall be held

responsible for any damage caused to existing services. Promptly notify the Architect if services are found which are not shown on drawings.

1.08 GUARANTEE:

A. Repair or replace any defective work, materials or part which may appear within 1 year of the date of acceptance. This shall include damage by leaks.

B. On failure to comply with the above guarantee within a reasonable length of time after notification is given, the Architect shall have the repairs made at the Contractor's expense.

1.09 MAINTENANCE AND OPERATING INSTRUCTIONS:

A. Instruct the Owner's authorized representatives in operation, adjustment and maintenance of all mechanical equipment and systems. Provide three copies of certificate signed by Owner's representatives attesting to their having been instructed.

B. Furnish three complete sets of operating and maintenance instructions bound in a hardback binder and indexed. Start compiling the data upon approval of list of materials. Final observation will not be made until booklets are approved by Architect.

C. These sets shall incorporate the following:

1. Complete operating instructions for each item of heating, ventilating, air conditioning and plumbing equipment.

2. Test data and air and water balancing reports as specified.

3. Typewritten maintenance instructions for each item of equipment listing in detail the lubricant to be used, frequency of lubrication, inspections required, adjustment, etc.

4. Manufacturer's bulletins with parts numbers, instructions, etc., for each item of equipment, properly stripped and assembled.

5. Temperature control diagrams and literature.

6. A complete list or schedule of all major valves giving the number of the valve, location and the rooms or area controlled by the valve. Identify each valve with a permanently attached metal tag stamped with number to match schedule. Post list in frame under plastic on wall in mechanical room or where directed.

1.10 SCHEDULE OF WORK:

A. All temporary connections required to maintain services, including adequate heat and cooling, during the course of this Contract shall be made without additional cost to the Owner. The normal function of the building must not be interrupted; notify the Owner seven (7) days in advance before disturbing any service.

1.11 RECORD DRAWINGS:

A. Upon completion of the work and as a precedent to final payment, deliver to the Architect originals of all Drawings showing the work exactly as installed. Also deliver to the Architect one

complete set of reproducibles of all Drawings showing the work exactly as installed. All Record Drawings shall be signed by the Contractor verifying their accuracy.

1.12 DELIVERY AND STORAGE:

A. All equipment, ducting and piping delivered to site shall be protected from the weather, humidity and temperature variations, dirt and dust and other contaminants.

PART 2 - PRODUCTS AND MATERIALS

2.01 GENERAL:

A. Materials or equipment of the same type shall be of the same brand wherever possible. All materials shall be new and in good condition.

2.02 ELECTRIC MOTORS:

A. Shall be Allis-Chalmers, General Electric, Gould, Lincoln, or equal, selected for quiet operation. Furnish motors with splashproof or weatherproof housings, where required or recommended by the manufacturer. Match the nameplate voltage rating with the electrical service supplied. Check electrical drawings. Provide a transformer for each motor not wound specifically for system voltage. The minimum efficiencies shall be as defined by IEEE 112 Test Method B and NEMA Standard MGI-112-53B.

2.03 MOTOR STARTERS:

A. Furnish starters with the proper size thermal overload units, ambient compensated. Provide 3-phase motor starters with 3-phase overloads. Magnetic starters shall have Hand-Off-Automatic switches and control transformers furnished integral with the starter when starter is serving an automatically controlled motor. Starters shall be Square D, Allen Bradley, or equal, in NEMA Type I enclosure inside and NEMA Type IIIR outside as required. Minimum starter size shall be 1.

2.04 VALVES AND FITTINGS:

A. Valves: Shall be DeZurik, Crane, Nibco, Kennedy, or equal.

1. Gate Valves thru 2-1/2" -- Crane #428, Kennedy #427, Nibco #T-595.

2. Gate Valves 3" thru 4" -- Crane #460 or #461, Nibco #F-617.

3. Gate Valves 5" and Larger --Demco NE, DeZurik #660 or Norris R3310 with throttling handle.

4. Check Valves 2-1/2" and smaller -- Muessco #203BP, Crane #36, Nibco #T-413.

5. Check Valves 3" and larger -- Muessco #105AP, Crane #373.

6. Gas Valves -- DeZurik #425SIRS-49.

7. Gas Cocks at Appliances -- ConBra Co. 50 Series.

8. Gas Pressure Regulators -- Reliance #1803 or #2003, Rockwell or equal with internal relief for LPG.

9. Valves in the ground shall be Crane #2487-1/2-0, Mueller #A-2380-21 or equal, and shall be installed in Christy Concrete Products #F1 valve box with C210 C.I. lid, Books #1-RT box with #1-RT C.I. lid or equal. Nut operated valves in Alhambra Foundry Co. #A-3004 or equal access boxes marked for service. Provide a tee handle wrench for each size. Set access boxes in 4" thick concrete pad, trowel smooth and edge, set flush with grade. Water service valve in ground shall be AWWA, 200 psi, nut operated.

10. Valves in copper lines shall be furnished with adapters, or may be solder joint type of equal quality to screw type valves.

11. OS&Y Gate -- Crane #459 thru 2", #467 for 2-1/2" and larger; Demco NE-H for 4" and larger.

12. Ball Valves -- Worcester #411TS, Nibco #T-560, 2" maximum (use for air, vacuum, steam and high pressure gases).

13. Vacuum Breakers, Makeup -- Cla Val Co. Type RP, Watts 909, reduced pressure type backflow preventer.

14. Vacuum Breakers, General -- SMR #P-701 (1/2" to 1"); #P-711 (1-1/4" to 2"); #P-714 (2" and larger) with check valves, pressure type. SMR #H-400 (1/2"); #H-403 (3/4") atmospheric type.

15. Flow Control Valves -- Bell & Gossett Circuit Setter Plus, Armstrong CBV, or equal thru 3", Circuit Sensor with hand valve above 3". Illinois Series 5000 will be acceptable thru 2".

16. Balance Valves -- Rockwell 142 thru 2", 143 above 2"; Walworth 1796 thru 2", 1797F-1718F above 2".

17. Provide gate or globe valves on inlet of each water heater and inlet and outlet of each pump whether shown or not.

18. Butterfly Valves: Keystone 100, Crane Monarch 2200 or equal.

B. Unions and Flanges:

1. Steel 2" and smaller -- 150# screwed black or galvanized malleable iron, match pipe, ground joint, brass-to-iron seat.

2. Steel 2-1/2" and larger -- 150# black flange union, flat faced, full gasket.

3. Copper or brass pipe or tubing 2" or smaller -- 150# cast bronze ground joint, bronze-to-bronze seat with copper-to-copper end connections.

4. Copper or brass pipe or tubing 2-1/2" and larger -- 150# brass flange union, flat faced, full gasket.

5. Gaskets - Hot and cold water -- Garlock Style 320D.

6. Flange Bolts -- Open-hearth bolt steel, square heads with cold pressed hexagonal nuts, cadmium plated in ground. Provide copper plated steel bolts and nuts or brass bolts and nuts for brass flanges.

2.05 HANGERS AND SUPPORTS:

All hanger components shall be Grinnell, Elcen, Super-Strut or equal.

A. Vertical Piping: Grinnell #261, Elcen #39, or equal, clamps attached to the pipe above each floor, to rest on the floor: Provide with two wraps of 10 mil PVC tape on copper tubing. Provide additional support at base of cast iron risers.

B. Individually Suspended Piping: Provide seismic bracing per Mason OPM #0038-13 where required. Hangers shall be Super-Strut C-711, Elcen #90, or equal complete with threaded rod. Provide insulation shield and hangers outside on all insulated water and steam piping.

Pipe Size	Rod Size
2" and smaller	3/8"
2-1/2 to 3-1/2"	1/2"
4" to 5"	5/8"
6"	3/4"
8 to 12"	7/8"

C. Trapeze Suspension: Super-Strut, Elcen, or equal, 1-5/8" width channel in accordance with manufacturer's published load ratings. No deflection to exceed 1/180 of a span.

D. Trapeze Supporting Rods: Shall have a safety factor of 5, securely anchor to building structure.

E. Pipe Straps: Super-Strut C-702, Speed Strut #650, or equal through 8" for ferrous pipe; C-701, Speed Strut #751, or equal, through 6" for copper pipe.

F. Concrete Inserts: Uni-Strut P-3200 continuous insert or M24 spot insert.

G. Pipe Rollers: Super-Strut C-728 up to 8"; C-721 for 10" and 12".

H. Above Roof: H frame made from Uni-Strut hot-dipped galvanized 1-5/8" single or double channel with P-2072A or P-2073A foot secured to roof and surrounded with waterproof pitch pocket.

I. Steel Connectors: Beam clamps with retainers.

J. Wood Connectors: Angle clips with through bolts in shear; no lag screws in tension.

2.06 SERVICE MARKERS:

A. 4" round by 30" long concrete marker, Haley Mfg., Co., Pinkerton, or equal with engraved brass identification plate.

2.07 PIPE PROTECTION:

A. Polyethylene Coating: Extruded polyethylene coating, X-Tru-Coat, or field wrap as in B,

Raychem "Thermofit" polyethylene sleeve joints, or field wrap as in B.

B. Tape Wrap: Pressure sensitive polyvinyl chloride tape, "Trantex #V-10 or V-20", "Scotchrap #50", Slipknot 100, or equal, with continuous identification. Tape shall be a minimum of 20 mils thick for fittings and irregular surfaces, 2 wraps, 50% overlap, 40 mils total thickness. Tape shall be laminated with a suitable adhesive. Widths as recommended by the manufacturer for the pipe size. Wrap 50'-0" or longer sections of piping with an approved wrapping machine.

C. Pabco Wrap: Pabco Specifications #D-40-240K double wrap, in accordance with manufacturer's recommendations or PVC as in B. Lap pipe wrap a minimum of 1/4" and stagger the second layer. All Pabco pipe wrapping shall be done by the manufacturer's agent and not by the Contractor, except the field joints.

D. Field Joints and Fittings: Pabco double wrap and Polyvinyl Chloride type as above. Provide at least 2 thicknesses of tape over the joint and extend a minimum of 4" over adjacent pipe covering. Build up with primer to match adjacent covering thickness. Width of tape on fittings shall not exceed 2". Tape shall adhere tightly to all surfaces of the fittings, without air pockets.

2.08 ACCESS DOORS:

Milcor, Newman, or equal, with concealed hinges, screwdriver locks, prime coated with rust inhibitive paint, and style of door to suit ceiling or wall construction. Access doors in acoustical tile ceilings shall be "Sesame" with tile recess. Doors shall be 14 gage C.R. steel and shall be 22" x 30", 24" x 24" in tile ceiling, unless otherwise noted or required, fire rated to match rating of surface in which installed. Doors in walls of toilet rooms, shall be stainless steel.

2.09 FLASHING:

All flashings shall be made of four pound sheet lead with 8" minimum skirt, Semco S1100-2 or S1100-4, Stoneman #1110-2 or 1110-4, or equal, and counter flashing.

PART 3 - EXECUTION

3.01 ELECTRICAL REQUIREMENTS:

A. Provide adequate working space around electrical equipment in compliance with the California Electric Code. Coordinate Mechanical Work with Electrical Work to comply.

B. Furnish and set in place all motors. Furnish necessary control diagrams and instructions for controls. Before permitting operation of any equipment which is furnished, installed or modified under this section, review all associated electrical work including overload protection devices and assume complete responsibility for correctness of electrical connections and protective devices.

C. Motors and control equipment shall conform to Standards of National Electrical Manufacturer's Association. All equipment and connections exposed to the weather shall be NEMA IIIR with factory wired strip heaters in each starter enclosure, and temperature control panel to inhibit condensation.

D. All power wiring, conduit, fuses, thermal overloads, and disconnect switches, and connection of all motors are under electrical work, Division 16. All wiring and conduit associated with the temperature control and indicating system is included in this section. Run all wiring in conduit in accordance with Division 16.

E. Electric Motors: All motors shall be rated for continuous operation at 115% of nameplate amperage throughout the entire operating cycle. Motors found exceeding the nameplate amperage shall be promptly replaced at not cost to the Owner. Horsepowers shown are minimum and shall be increased as necessary to comply with above requirements.

F. Motor Starters: Furnish magnetic motor starter for all equipment furnished under this section except those shown in motor control centers.

G. Provide OSHA label indicating device starts automatically.

3.02 PRIMING AND PAINTING:

A. Perform all priming and painting on the equipment and materials as specified herein.

B. Priming: Exposed ferrous metals, including piping, which are not galvanized or factory finished shall be primed. Black steel pipe exposed to the weather shall be painted one coat of Rust-Oleum #769 primer and one coat of #960 primer. Items to be primed shall be properly cleaned by effective means, free of rust, dirt, scale, grease, wax and other deleterious matter. Any abrasion or other damage to the shop or field prime coat shall be properly repaired and touched up with the same material used for the original priming.

C. Finish Painting:

1. Equipment and machinery located in fan rooms, equipment rooms and similar purpose rooms and at other locations when specified, shall be furnished with a standard factory-applied beaked enamel finish in approved uniform colors. At the Contractor's option, equipment and machinery may be field-painted hereunder with two coats consisting of an air-dried synthetic industrial enamel undercoater and enamel as approved over the shop or factory-applied primer. All exposed ferrous metals, including piping located in fan rooms, equipment rooms, and boiler rooms shall be painted one coat of an approved paint, of color selected, over the primer. Canvas insulation jackets, including piping located in fan rooms, equipment rooms, and boiler rooms shall be painted two coats of paint of color selected. Mechanical Work, except as described herein, occurring in rooms or spaces required to be painted on walls, and/or ceilings will be finish painted as described above for equipment and machinery in equipment rooms.

D. See Painting Section for detail requirements and finishes.

3.03 EXCAVATING:

A. Perform all excavating required for work of this section.

B. Unless shown otherwise, provide a minimum of 3'-0" above top of pipe to finished grade outside so as to be below frost line and a minimum of 1'-0" under building from bottom of slab. Trim trench bottom by hand or provide a 4" deep minimum bed of sand to provide a uniform grade and firm support throughout entire length of pipe. For cement asbestos pipe, insulated pipe, glass pipe, or plastic pipe, bed the pipe in sand.

C. Maintain all warning signs, barricades, flares and red lanterns as required.

D. For all trenches 5' or more in depth, shoring, bracing, slipping or other provisions shall be made

for worker protection from the hazard of caving ground during the excavation of such trenches in accordance with Cal OSHA.

3.04 BACKFILLING:

A. Backfill shall comply with applicable compaction provisions of Division 2 of these specifications.

B. Backfill plastic pipe and insulated pipe with sand for a minimum distance of 12" above the top of the pipe. Compact sand backfill by impact tamper and concrete vibrator.

C. Except under existing or proposed paved area, walks, roads, or similar surfaces, and in cases where rock is encountered, backfill more than 1'-0" above the top of the pipe shall be made using suitable excavated material or other approved material as necessary. Place the backfill in 8" layers, measured before compaction, and compact with impact hammer to at least 95% relative compaction per ASTM D1557.

D. Entire backfill for excavations under existing or proposed pavements, walks, roads, or similar surfaces, under new slabs on grade and where rock is encountered, shall be made with clean sand compacted with mechanical tamping equipment to at least 95% relative compaction per ASTM D1557. Remove excess earth from site or deposit on site if so directed by the Architect.

E. Replace or repair to its original condition all sod, concrete, asphalt paving, or other materials, including landscape sprinklers, disturbed by the trenching operation. Repair within the guarantee period as required.

3.05 THRUST BLOCKS:

A. Provide concrete anchors or thrust blocks on all cast iron and cement asbestos water and forced main sewer lines in the ground. Install thrust blocks at all changes in direction and at all connections to the mains 2" and larger. Form thrust blocks by pouring concrete between the pipes and trench wall. They shall be adequate in size and placed to take all thrusts created by the maximum internal water pressure.

3.06 INSTALLATION OF PIPING SYSTEMS:

A. General:

1. All piping shall be concealed unless shown or otherwise directed.

2. Where piping or conduit is left exposed within a room, the same shall be run true to plumb, horizontal or intended planes. Where possible, uniform margins are to be maintained between parallel lines and/or adjacent wall, floor or ceiling surfaces.

3. Horizontal runs of pipes and/or electrical conduit suspended from ceilings shall provide for a maximum headroom clearance. The clearance shall not be less than 6'-8" without written approval from the Architect.

4. Minor changes in locations of equipment, piping, ducts, etc., from locations shown shall be made when directed by the Architect at no additional cost to the Owner providing such change is ordered before such items of work, or work directly connected to same are installed and providing no additional material is required.

5. Grade all water-circulating piping, flow and return, to provide for drainage of lines and elimination of air.

6. Close ends of pipe immediately after installation. Leave closure in place until removal is necessary for completion of installation.

7. Each piping system shall be thoroughly flushed and proved clean before connection to equipment.

8. Pipe the discharge of each relief valve, air vent, backflow preventer and similar device to floor sink or drain.

9. Install exposed polished or enameled connections with special care showing no tool marks or threads at fittings.

10. Tracer Wires (for Non-Metallic Pipe):

    a. Install tracer wire where shown for non-metallic pipe in ground outside of buildings. Use AWG #12 tracer wire and lay continuously below vertical projection of pipe so that it is not broken or stressed by backfilling operations. Solder all joints.

    b. Locate terminals where shown. Terminals: Precast concrete box and cast iron locking traffic cover, Brooks 3TL, or equal; cover marked with name of service; 6" of loose gravel below box. Plastic terminal board with brass bolts; identify line direction with plastic tags. Test for continuity between terminals after backfilling in presence of Construction Supervisor.

    c. Option: Use electronically detectable plastic tape with metallic core, Terra Tape D, manufactured by Griffolyn Co., or equal; tape 2" wide, continuously imprinted "CAUTION, WATER (GAS, etc.) LINE BELOW". Install, with printed side up, directly over pipe, 8" below finish grade. Backfill material shall be as previously specified for the particular condition where pipe is installed, but avoid use of crushed rock or of earth with particles larger that 1/2" within the top 12" or backfill. Take precautions to insure that tape is not damaged or misplaced during backfill operations. Terminal boxes not required.

11. Use reducing fittings; bushings shall not be allowed. Use eccentric reducing fittings wherever necessary to provide free drainage of lines and passage of air.

B. Sleeves: Install AMI sleeves of sufficient size to allow for free motion of pipe, 24 gage galvanized steel. The space between pipe and sleeves through floor slabs on ground, through outside wall above or below grade, through roof, and other locations as directed shall be caulked with oakum and mastic and made water-tight. At Contractor's option pipes through slabs on grade may be wrapped with 1" thick fiberglass insulation to completely isolate the pipe from the concrete in lieu of sleeves. Link seal casings may be used in lieu of caulking.

C. Floor, Wall and Ceiling Plates: Fit all pipe with or without insulation passing through walls, floors, or ceilings, and all hanger rods penetrating finished ceilings with chrome plated or stainless steel plates. Openings through air plenums shall be sealed airtight.

D. Flashing: Furnish and install around each pipe, where it passes through a roof, a flashing and

counterflashing.

E. Hangers and Supports:

1. General: Support all piping so that it is firmly held in place by approved iron hangers and supports and special hangers as required. Rigidly fasten hose faucets, fixture stops, and similar items to the building construction. All hanger material shall be approved by the Architect before installation. Support no piping or ductwork by any plumbers tape, wire, rope, wood, or other makeshift devices.

2. Pipe Support and Hanger Spacing Schedule:

	1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	3	4	4 & Up
Standard weight steel pipe; Sch. 40 (liquid filled)	5'	5'	6'	6'	7'	8'	9'	10'	10'	10'
Standard weight steel pipe; Sch. 40 (vapor filled)	6'	8'	8'	10'	10'	10'	10'	10'	10'	10'
Copper tubing Type K	4'	4'	5'	5'	6'	6'	7'	8'	9'	10'
Copper tubing Type L	3'6"	4'	4'6"	5'	5'6"	6'	7'	7'6"	8'6"	10'
IPS Brass Pipe	5'	6'	7'	8'	9'	10'	10'	10'	10'	10'
Cast Iron	Support at every joint and ten-foot o.c. maximum.									

3. On insulated pipes, install the hangers on the outside of the pipe covering and not in contact with the pipe. Provide rigid insulation and a 12" long, 18 gage galvanized sheet iron shield between the hanger whenever hangers are installed on the outside of the pipe covering.

4. Burning or welding on any structural member may only be done if approved by the Architect.

5. Insulate copper tubing from ferrous materials and hangers with 2" thickness of 3" wide 10 mil polyvinyl tape wrapped around pipe.

6. No valve or piece of equipment shall be used to support the weight of any pipe.

7. Provide a support or hanger close to each change of direction of pipe either horizontal or vertical.

F. Anchors:

1. Piping subject to expansion or contraction shall be provided with anchors and expansion loops or joints as required. Provide adequate guides to prevent misalignment.

G. Fireproofing:

1. The annular space between the pipe sleeves and the pipe and between duct openings and ducts through all floors and walls shall be protected by a UL-listed Fire Stopping System, 3M, Fire Barrier, Dow Firestop or Nelson Firestop.

3.07 SERVICE MARKERS:

A. Mark the location of each plugged or capped pipe, set marker in 6" x 6" concrete pad flush with finish grade.

3.08 PIPE JOINTS AND CONNECTIONS:

A. Cutting: Cut piping and tubing square, ream cut ends to full bore, remove rough edges, burrs, loose materials.

B. Threaded Pipe: Make joints with Rectorseal #5 or Permatex #1 thread lubricant or joint tape. Use no caulking of any kind. Remake leaky joints with new materials.

C. Copper and Brass Pipe and Tubing (except Control Piping): Make all joints with silver brazing alloy, Sil-Fos or equal, 1100 degrees F. melting point or greater, ASTM B-260, except that water piping 1-1/4" and smaller not buried in the ground or concrete and Type DWV plumbing piping may be made up with 95-5 tin-antimony, ASTM B-32, Grade 5A solder. Boss or saddle type fittings or mechanically extracted tube joints will not be allowed. Use leadless solder for potable water piping.

D. Welded Pipe:

1. Make up with oxyacetylene or electric arc process.

2. All welding shall conform to the American Standard Code for Pressure Piping ASA B-31, Section 6, Chapter 4, and Appendix A. When requested by the Architect, furnish certification from an approved testing agency or National Certified Pipe Welding Bureau that the welders performing the work are qualified.

3. All line welds shall be of the single "V" butt type. Welds for flanges shall be of fillet type.

4. Where the branch is 2 pipe sizes smaller than the main or smaller, Bonney Weldolets, Threadolets, Nibco, or equal, may be used in lieu of welding tees.

E. Cast Iron Soil Pipe:

1. Make-No Hub joints with torque wrench. Wrought iron, steel, or copper pipe shall have a ring or part of a coupling screwed on to form a spigot end where connected to a No-Hub joint. Suspended No-Hub pipe shall have sway brace at 20'-0" maximum spacing.

2. Ty-Seal, Dual-Tite, or equal, pipe and fittings may be used at the Contractor's option.

3. Connect building drain piping to outside service pipe with reducers or increasers as required. Caulking of smaller pipe into the larger without a reducer or increaser will not be permitted. Provide for changes in material types.

3.09 UNIONS AND FLANGES:

A. Install Epco, or equal, dielectric unions or flanges at points of connection between copper or brass piping material and steel or cast iron pipe or material except in drain, waste, vent, or rainwater piping. Bushings or couplings shall not be used. Dielectric unions shall not be installed below grade.

B. Install unions, whether shown or not, at each connection to all equipment and tanks, at one connection to each valve or cock, and at all connections to all automatic valves, such as temperature control valves.

C. Locate the unions for easy removal of the equipment, tank or valve.

3.10 PIPE PROTECTION:

A. Wrap all underground bare galvanized and black steel pipe and copper pipe, buried in the ground and to 6" above grade, including piping in conduit, with a corrosive protective wrap as specified under “Pipe Protection” in Part 2 of Section 22 40 00.

B. Cleaning: Clean all piping thoroughly before wrapping.

C. Inspection: Damaged or defective wraps shall be repaired as directed. No wrapped pipe shall be covered until approved by the Architect.

D. Testing: Test completed piping with Tinker and Rasor Co. test machine (San Gabriel, Calif. 626/287-7942).

E. Covering: No rocks or sharp edges shall be backfilled against the wrap. when backfilling with other than sand, protect wrap with an outer wrapping of Kraft paper. Leave in place during backfill.

3.11 ACCESS DOORS:

A. Furnish and install access doors wherever required whether shown or not for easy maintenance of mechanical system; for example, at concealed valves, strainer, traps, cleanouts, dampers, motors, controls, operating equipment, etc. Access doors shall provide for complete removal and replacement of equipment.

3.12 CONCRETE WORK:

A. Concrete work required for work of this section shall be included under another section of the specifications, unless otherwise noted. This shall include all poured in place concrete work for installing precast manholes, catch basins, etc., unless the work is specifically indicated on the drawings to be furnished under this section. Thrust blocks, underground anchors, and pads for cleanouts, valve access boxes and washer boxes are included under this section of the specification. Concrete shall be 2500 psi test minimum.

3.13 INSULATION WORK:

A. General:

1. All insulation shall be done by a contractor specifically licensed for insulation work. Insulation applied by the mechanical and plumbing contractor is not acceptable.

2. The term "piping" used herein shall include pipe, air separators, valves, strainers and fittings. Apply insulating cement to fittings, valves and strainers and trowel smooth to the thickness of adjacent covering. Cover with jacket to match piping. Extend covering on valves up to the bonnet. Leave strainer cleanout plugs accessible. Valve and fitting covers may be preformed PVC. Provide rigid insulation, 18" minimum length at each pipe hanger. Seal ends of insulation with jacket.

3. Do not insulate flanges and unions on high temperature piping. Insulate unions and pump bodies on chilled water and combination hot and chilled water systems with three heavy layers of Mortell's No-Drip Paint, 1/16" minimum total thickness or Armstrong Armaflex Tape per manufacturer's recommendations.

4. Clean thoroughly, test, and have approved, all piping and equipment before installing covering.

5. All insulation, adhesive coverings and jackets including pre-insulated flexible ductwork shall have a flame spread of 25 or less and developed smoke rating of 50 or less tested in accordance with ASTM E84.

B. Insulation of Piping:

1. Domestic hot and tempered water shall be insulated with 1" thick 3-1/2# density fiberglass with ASJ-SSL jacket.

2. Urethane insulation will not be allowed above ground or on hot water or steam piping.

3. On all insulated piping exposed to the weather apply .015 aluminum jacket secured with 1/2" aluminum bands on 12" centers. Cover fittings with six ounce canvas and two coats of Foster's 30-36 or Zeston plastic fitting covers. Insulation shall be vaportight before applying metal jacket or plastic covers.

4. All insulated piping exposed in occupied spaces or mechanical rooms shall have a Proto or equal, 25/50 rated PVC jacket. Color as selected, installed and sealed per manufacturer's recommendations.

5. Refrigerant piping, including all fittings, shall be insulated with nominal 3/4" thick Armstrong Armaflex 22, Owens-Corning Flex Tubing, or equal. Seal all joints with Armstrong 520 adhesive, Owens-Corning 500 adhesive, or equal. Insulation exposed to the weather shall be finished with two coats of Armstrong white Armaflex finish, or equal. Apply insulation in strict accordance with manufacturer's recommendations.

C. Duct Insulation:

1. Wrap all unlined concealed supply and return ducts with O.C. Fiberglas All-Service duct wrap with a reinforced foil Kraft vapor barrier facing 2" thick and 3/4# per cubic foot

density. Wrap insulation entirely around duct and wire securely in place with #16 wire 12" o.c. and each side of each standing seam and over each insulation joint. Lap all insulation joints 3" minimum. Insulate ducts installed tight against other work before hanging in place.

2. All ducts and plenums in Fan Room shall be insulated with 1-1/2" (2" outside building) thick Fiberglas 705 insulating board with factory-applied foil facing. Insulation shall be adhered to ducts with Type B STICKLIPS at 18" o.c. cemented in place. Wrap insulation with 8 ounce canvas sized with Foster's Seal-fas mastic. Apply one final undiluted coating of Foster's 30-76 white insulation coating.

3. Install acoustical lining in all supply, return and mixed air ducts and plenums exposed in the Equipment Room or outside the building and where marked; and additional length as necessary to provide, in all cases, a minimum of 10'-0" in each direction from the fan, fan casing, or unit casing. Line exhaust ducts for a minimum of 10'-0" from fan inlet and 10'-0" downstream from each register or grille. Line all transfer ducts. Lining shall be 1" thick vinyl face black matt Fiberglas Aeroflex Type 150, 1-1/2# per cubic foot, J-M, or equal. Cement the lining in place with 100% coverage of Foster's 85-20, 3M #38, or equal, and coat all edges and joints. In addition, all lining shall be fastened with Sticklips or welded pins spaced at 18" maximum centers both ways. No bare fiberglass shall be left exposed to air stream.

4. Seal airtight all seams of all supply, return and exhaust ducts except those exposed in the conditioned space with Hardcast Inc. FTA-20 adhesive and Hardcast DT-Tape installed in accordance with manufacturer's directions.

5. Seal watertight all joints of all ductwork exposed to the weather with 6 ounce canvas dipped in Arabol; cover the canvas with a heavy coat of Foster's 30-76, or equal, no dilution.

3.14 EQUIPMENT IDENTIFICATION:

A. Identify each piece of equipment with an engraved brass tag fastened with screws. For example - EXHAUST FAN 2.

3.15 PIPE IDENTIFICATION:

A. Identify each piping system and indicate the direction of flow by means of Idento Bands (Idento Metal Products Co.) or SETMARK pipe markers. Apply the markings after all painting and cleaning of the piping and insulation is completed.

B. Apply the legend and flow arrow at all valve locations; at all points where the piping enters or leaves a wall, partition, cluster of piping or similar obstruction; and at approximately 50'-0" intervals on pipe runs. Variations or changes in locations and spacing may be made with the approval of the Architect. There shall be at least one marking in each room. Markings shall be located for maximum visibility from expected personnel approach.

C. Wherever two or more pipes run parallel, the markings shall be supplied in the same relative location on each.

D. The legends and flow arrows shall conform to ANSI A13.1.

E. The sizes of the letter and flow arrows shall be as follows:

Outside Diameter of Pipe or Covering (Inclusive)	Size of Letter	Minimum Length of Flow Arrow
5/8" to 2"	1/2"	2-1/2"
2-1/2" and Larger	1"	4"

F. Each hand valve on non-potable water piping shall be labeled with a metal tag stamped "DANGER -- NON-POTABLE WATER" in one-quarter inch (1/4") high letters.

3.16 GUARDS:

A. General: Belt drive, gear drive shafts, couplings, fan inlets and outlets, and running equipment shall be properly protected by guards as required by the CCR, Title 8, Division of Industrial Safety, Sub Chapter 7, General Industry Safety Orders, Articles 31 through 36, whether shown on the drawings or not.

B. Construction: Guards shall be factory furnished or made of expanded metal with angle iron framework. Guards for belt drives shall have an easily removable section for replacement of belts. Openings shall be provided at shaft ends for taking rpm readings.

3.17 ANTI-VIBRATION BASES AND HANGERS:

A. All ventilating and air conditioning equipment shall operate under continuous demand without objectionable vibration. Contractor shall be sure that above result is achieved. Isolate all equipment connections, including conduit, piping, drains, etc.

B. Air conditioning units and all fans shall be supported on anti-vibration bases or hangers. Other equipment and pumps shall be supported on anti-vibration bases, pads or hangers, when shown on Drawings or specified with equipment. Isolators and supporting bases shall be supplied by single manufacturer, Kinetics, Korfund, or equal. Type of mounting and supporting base for each piece of equipment shall be as tabulated on equipment schedule or as hereinafter specified. Individual mounts shall be Kinetics Type FPS, or equal. Contractor shall provide calculations for isolators and mounting acceptable to reviewing authority.

C. All piping in Mechanical Equipment Rooms and piping three supports away from mechanical equipment mounted on vibration isolators shall be isolated from structure by means of vibration and noise isolators. Suspended piping shall be isolated with combination Spring and Fiberglass hangers in supporting rods. Hangers shall be Type H. Floor-mounted piping shall be supported directly on Spring Mounts, Type S. Vertical pipe risers shall be isolated from structure by means of vibration and noise isolating Expansion Hangers, Type XH.

D. Isolator manufacturer's submittal shall include complete design for supplementary bases, tabulation of design data on isolators, including O.D. free operating, and solid heights of springs, free and operating heights of neoprene or fiberglass isolators, and isolation efficiency based on lowest operating speed of equipment supported.

3.18 SPECIAL SEISMIC REQUIREMENTS:

A. Supports for all piping and ductwork shall be in accordance with SMACNA "Guidelines for Seismic Restraints of Mechanical Systems and Plumbing Piping Systems".

B. Expansion Anchors in Hardened Concrete:

1. Maximum Values: The allowable shear and withdrawal shall not exceed values permitted for bolts cast into concrete, as defined in Section 2624 of Title 24, with the 100% increase provided in Footnote 1 to CCR Table 26-F.

2. Qualification Tests: The allowable shear and withdrawal load shall be based on qualification tests of at least three (3) test specimens, using a factor of safety of five (5) on the average of the test values, or a factor of safety of four (4) on the lowest test value, whichever is lower. Until the test data for the various anchors can be evaluated, use not more than 80% of the allowable load listed in the ICBO Research Committee Recommendations for the specific anchor.

3. Installation: The anchors must be installed in accordance with the requirements given in ICBO Research Committee Recommendations for the specific anchor.

4. Limitations on Anchors in Withdrawal: Anchors acting in withdrawal shall not be used for major connections such as anchoring tilt-up walls, tie-downs, heavy continuously applied loads, frequent vibratory loads, etc.

5. Job Testing: Fifty percent of the anchors shall be load-tested on each job to twice the allowable capacity in tension, except that if the design load is less than 75 pounds; only one anchor in ten need be tested. If any anchor fails, all anchors must be tested. The load test shall be performed in the presence of the project inspector.

   The load may be applied by any method that will effectively measure the tension in the anchor, such as direct pull with a hydraulic jack, a torque wrench calibrated using the specific anchor, calibrated spring-loading devices, etc. Anchors in which the torque is used to expand the anchor without applying tension to the bolt may not be verified with a torque wrench.

3.19 TESTS AND ADJUSTMENTS:

A. Test the installation in accordance with the following requirements and all applicable codes. Notify the Architect at least 7 days in advance of any test. All piping shall be tested at completion of roughing-in, or at other times as directed by the Architect.

B. Furnish all necessary materials, test pumps, gases, instruments and labor required for testing. Tests shall be witnessed by the Architect.

C. Isolate from the system all equipment which may be damaged by test pressure.

D. Test Schedule: No loss in pressure or visible leaks shall show after four hours at the pressures indicated.

System Tested	Test Pressure PSI	Test With
Sanitary Sewer, Drain, Vent	10 Ft. Hd.	Water
Storm Drain, Condensate Drains	10 Ft. Hd.	Water
Domestic Hot and Cold Water	125	Water
Gases	100	Air & Soap

All piping, including underground, connected to the fire sprinkler system shall be tested and certified in accordance with ISO requirements.

E. Testing, Evacuating, Charging and Lubrication of Refrigeration Systems:

1. Pressurize with dry nitrogen and/or refrigerant to 300 psig and test all joints with an electronic detector or halide torch. Release the pressure and attach a high vacuum pump. Evacuate to 4mm (4000 microns) and hold for 30 minutes. Break to 5 psig with dry nitrogen or R-22 and allow to remain in the system for ten minutes. Evacuate to 2mm (2000 microns) and hold for 30 minutes. Use a mercury manometer or electronic vacuum gauge. Do not start timing until recommended vacuum range is reached.

2. At the end of the evacuation, if the system has been proved leakfree, charge with refrigerant and fill the crankcase to the oil level specified by the manufacturer. All refrigerant oil shall be delivered to the location in sealed containers.

3. Replenish for a period of one year without cost to the Owner all refrigerant and oil required to maintain the proper levels.

F. Perform operational tests under simulated or actual service conditions, including one test of complete plumbing installation with all fixtures and other appliances connected.

G. Should any material or work fail in any of these tests, it shall be immediately removed and replaced by new material, any portion of the work replaced shall again be tested by Contractor at his own expense.

H. Instruct Owner's operating personnel during test and operating adjustment period. Lubricate each item of equipment, including motors, before operation.

3.20 MISCELLANEOUS FRAMES AND COVERS:

A. Furnish all steel channel frames and covers in connection with concrete work required by this Section of the Specification. All items shall be welded construction, and except as noted, hot-dip galvanized after fabrication painted two coats of chromate before delivering to the jobsite.

END OF SECTION

SECTION 22 40 00 - PLUMBING

PART 1 - GENERAL

1.1 The General Conditions and Supplementary Conditions apply to this Section.

1.2 SCOPE:
Provide plumbing where shown on the Drawings, as specified herein, and as needed for a complete and proper installation including, but not necessarily limited to:

A. Domestic hot and cold water piping systems

B. Drain, waste, and vent systems

C. Gas, water and sewer service connections per local requirements

D. Plumbing fixtures and trim as shown on the Drawings

E. Condensate lines

1.3 General Contractor shall provide temporary sanitary facilities for all trades.

1.4 DRAWINGS:

A. Examine all drawings prior to starting of work and report any discrepancies in writing to the Architect.

B. Verify all dimensions at the building site and check existing conditions before beginning work. Make changes which are necessary to install the work in harmony with other crafts; they shall be first approved by the Architect.

C. Execute work mentioned in the specifications and not shown on the drawings, or vice versa, the same as if specifically mentioned in both.

D. 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.

1.5 CODES AND REGULATIONS:

A. Provide all work and materials in full accordance with the latest rules and regulations of the:

1. 2019 California Building Code

2. 2019 California Plumbing Code

3. 2019 California Mechanical Code

4. 2019 California Electrical Code

5. 2019 California Fire Code

6. Title 24, California Code of Regulations.

Nothing in these plans or specifications is to be construed to permit work not conforming to these codes. Furnish without extra charge, any additional material and labor required to comply with these rules and regulations.

1.6 SUBSTITUTIONS AND MATERIALS LIST:

A. Product names are used as qualitative standards, however other materials or methods shall not be used unless approved in writing by the architect. The burden of proof as to the equality of any proposed material shall be upon the contractor, and the architect's decision is final. Only one request for substitution shall be considered for each item. Equipment capacities specified are minimum acceptable.

B. Submit in indexed folders, five (5) sets of submittals for approval within 35 days after the award of the contract. The submittals shall be accompanied by equipment shop drawings, pump performance curves, and other pertinent data, showing the size, capacity and the proposed materials to be used. Submittals shall be provided, whether substitutions are made or not, and shall be listed in the order in which they appear in the schedules. Submittals shall be provided and approved prior to start of construction.

C. Any mechanical, electrical, structural or other changes required for the installation of any substituted equipment shall be made to the satisfaction of the architect and without additional cost to the owner. Approval by the architect of the substituted equipment and/or dimensional drawings does not waive these requirements. With submittal, provide drawings showing substituted equipment.

D. Approval of material shall not be construed as authorizing any deviations from the specifications unless the attention of the architect has been directed to the specific deviations.

E. Furnish to the Inspector, upon request, complete installation shop drawings of the same approved substitutions and drawings.

1.7 STERILIZATION CERTIFICATE:
Upon completion of water line sterilization, deliver to the Architect two copies of an acceptable "Certificate of Performance" for that activity.

1.8 MANUALS:

A. Upon completion of the work of this Section, deliver to the Architect one copy of an operation and maintenance manual compiled in accordance with the provisions of the General Requirements.

B. Include within each manual a copy of the Project Record Documents showing all work of this Section.

1.9 FIELD MEASUREMENT:
Make necessary measurements in the field to assure precise fit of items included in plumbing. Verify dimensions with all framing and concrete work prior to installing any components. Notify architect immediately of any discrepancies.

1.10 Install fixtures for accessibility requirements at locations shown on plans.

PART 2 - MATERIALS

2.1 FIXTURE SCHEDULE (As shown on Plumbing Drawings – see PLUMBING FIXTURE SCHEDULE)

2.2 PIPE SCHEDULE (As shown on Plumbing Drawings – see PLUMBING MATERIAL SPECIFICATIONS)

2.3 MISCELLANEOUS MATERIALS:

A. Gate valves: Provide solid wedge disc, rising stem, WOG; rising stem: Provide Nibco T-126 bronze, screwed, or 5-126, solder.

B. Globe valves: Provide replaceable composition disc suitable for 200 degree F water: 2 1/2 and smaller; Provide Nibco F-718-B, bronze, screwed.

C. Gas cocks: 2" and smaller: Provide 250#, bronze, screwed, square head, 125# (Rockwell Fig 142).

D. Ball valves: two or three piece construction, forged bronze body, chrome plated brass ball, threaded ends, Teflon seats, PTFE or reinforced Teflon stem seals, lever handles. Milwaukee BA100/150, BA300/350.

E. Flashing: Where pipes of this Section pass through the roof, flash with 24 ga. galvanized sheet metal, counter flashing to be 24 ga. sheet metal.

F. Traps for lavatories and sinks, except service sinks, chrome plated 17-ga. brass with clean out.

G. Insulation:

1. Provide 1-1/2” thick, 3 ½ pound per cubic foot fiberglass with all-service jacket (aluminum jacket with stainless steel bands outdoors) for all hot water and hot water returns (service at 105-140 ℉ up to 4” diameter.

2. Pipe wrapping

a. Steel piping in concrete or underground:

(1) Wrap with 20 mil tape.

(2) Fittings and other joints: Wrap in the field with 20 mil tape and primer.

(3) Provide 50% overlap on tape weld rubber coating.

b. Sleeves: Where pipes pass through concrete, masonry, or stud walls, or pass through ceilings, provide a sleeve of the size required.

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.

I. Fixtures and Equipment: Provide complete plumbing fixture, trim, and equipment where shown on the Drawings.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS:
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 PLUMBING SYSTEM LAYOUT:

A. Lay out the plumbing system in careful coordination with the Drawings, determining proper elevations for all components of the system and using only a minimum number of bends to produce a satisfactorily functioning system.

B. Follow the general layout shown on the Drawings in all cases except where other work may interfere.

C. Lay out pipes to fall within partition, wall, or roof cavities, and to not require furring other than as shown on the Drawings.

3.3 Perform trenching and backfilling associated with the work of this Section in strict accordance with all provisions of these Specifications.

A. Cut bottom of trenches to grade. Make trenches 12" wider than the greatest dimension of the pipe.

B. Bedding and backfilling:

1. Install piping promptly after trenching. Keep trenches open as short a time as practicable.

2. Under the building, install pipes on a 6" bed of damp sand. Backfill to bottom of slab with damp sand.

3. Outside the building, install underground piping on a 6" bed of damp sand. Backfill to within 12" of finish grade with damp sand. Backfill remainder with native soil.

4. Do not backfill until installation has been approved and until Project Record Documents have been properly annotated.

3.4 INSTALLATION OF PIPING AND EQUIPMENT

A. General:

1. Proceed as rapidly as the building construction will permit.

2. Thoroughly clean items before installation. Cap pipe openings to exclude dirt until fixtures are installed and final connections have been made.

3. Cut pipe accurately, and work into place without springing or forcing, properly clearing windows, doors, and other openings. Excessive cutting or other weakening of the building will not be permitted.

4. Show no tool marks or threads on exposed plated, polished, or enameled connections from fixtures. Tape all finished surfaces to prevent damage during construction.

5. Make changes in directions with fittings; make changes in main sizes with eccentric reducing fittings. Unless otherwise noted, install water supply piping with tap tees feeding up to fixtures.

6. Run horizontal sanitary and storm drainage piping at a uniform grade of 1/4" per ft, unless otherwise noted. Run horizontal water piping with an adequate pitch upwards indirection of flow to allow complete drainage.

7. Provide sufficient swing joint, ball joints, expansion loops, and devices necessary for a flexible piping system, whether or not shown on the Drawings.

8. Support piping independently at pumps, coils, tanks, and similar locations, so that weight or pipe will not be supported by the equipment.

9. Pipe the drains from pump glands, drip pans, relief valves, air vents, and similar locations, to spill over an open sight drain, floor drain, or other acceptable discharge point, and terminate with a plain end unthreaded pipe 2" above the drain.

10. Securely bolt all equipment, isolators, hangers, and similar items in place.

11. Support each item independently from other pipes. Do not use wire for hanging or strapping pipes.

12. Provide complete dielectric isolation between ferrous and non-ferrous metals.

13. Provide union and shut off valves suitably located to facilitate maintenance and removal of equipment and apparatus, whether shown or not.

14. Provide adequate drainage slope on condensate drains.

15. Equipment access:

    a. Install piping, equipment, and accessories to permit access for maintenance. Relocate items as necessary to provide such access, and without additional cost to the Owner.

    b. Provide access doors where valves, water hammer arrestors, motors, or equipment requiring access for maintenance are located in walls or chases or above ceilings. Coordinate location of access doors with other trades as required.

B. Pipe Joints

1. Copper tubing:

    a. Cut square, remove burrs, and clean inside of female filling to a bright finish.

        (1) Apply solder flux with brush to tubing.

        (2) Remove internal parts of solder-end valves prior to soldering.

    b. Provide dielectric unions at points of connection of copper tubing to ferrous piping and equipment.

    c. For joining copper tubing, use:

(1) Water piping 3" and smaller: “Lead free” solder;

(2) Underground: “sil-fos” brazing.

2. Screwed piping:

a. Deburr cuts.

(1) Do not ream exceeding internal diameter of the pipe.

(2) Thread to requirements of ANSI B2.1.

b. Use Teflon tape on male thread prior to joining other services.

3. Leaky joints:

a. Remake with new material.

b. Remove leaking section and/or fitting as directed.

c. Do not use thread cement or sealant to tighten joint.

J. Pipe Supports:

1. Support suspended piping with clevis or trapeze hangers and rods.

2. Space hangers and support for horizontal steel pipes according to the following schedule:

Pipe size:	Maximum spacing on centers:
1-1/4" and smaller	8'-0"
1-1/2" to 3":	10'-0"
4" to 5":	14'-0"

3. Space hangers and supports for horizontal copper tubing according to the following schedule:

Tube size:	Maximum spacing on centers:
1" and smaller	6'-0"
1-1/2"	7'-0"
2":	8'-0"
2-1/2":	9'-0"
3" and larger:	10'-0"

4. Provide sway bracing on hangers longer than 18".

5. Support vertical piping with riser clamps secured to the piping and resting on the building structure. Provide at partition top plates.

6. Provide insulation continuous through hangers and rollers. Protect insulation by galvanized steel shields.

7. Arrange pipe supports to prevent excessive deflection, and to avoid excessive bending stress.

8. Support piping from inserts or anchors in concrete slabs.

9. Hubless piping:

   a. Provide hangers on the piping at each side of, and within 6" of, hubless pipe coupling so the coupling will bear no weight.

   b. Do not provide hangers on couplings.

   c. Provide hangers adequate to maintain alignment and to prevent sagging of the pipe.

   d. Make adequate provision to prevent shearing and twisting of the pipe and the joint.

K. Sleeves and Openings

1. Provide sleeves for each pipe passing through walls, partitions, floors, roofs, and ceilings.

   a. Set pipe sleeves in place before concrete is placed.

   b. For uninsulated pipe, provide sleeves two pipe sizes larger than the pipe passing through, or provide a minimum of 1/2" clearance between inside and outside of the pipe.

   c. For insulated pipe, provide sleeves of adequate size to accommodate the full thickness of pipe covering, with clearance for packing and caulking.

2. Caulk the space between sleeve and pipe or pipe covering, using a noncombustible, permanently plastic, waterproof, non-staining compound which leaves a smooth finished appearance, or pack with noncombustible asbestos cotton, rope, or fiberglass to within 1/2" of both wall faces, and provide the waterproof compound described above.

3. Finish and escutcheons:

   a. Smooth up rough edges around sleeves with plaster or spackling compound.

   b. Provide 1" wide chrome or nickel plated escutcheons on all pipes passing through walls, floors, partitions, ceilings, and similar locations.

      (1) Size the escutcheons to fit pipe and covering.

      (2) Hold escutcheons in place with set screw.

L. Cleanouts:

1. Secure the Architect’s approval of locations for cleanouts in finished areas prior to installation.

2. Provide cleanouts of same nominal size as the pipes they serve.

3. Make cleanouts accessible. After pressure tests are made and approved, thoroughly graphite the cleanout threads.

M. Valves:

1. Provide valves in water and gas systems. Locate and arrange so as to give complete regulation of apparatus, equipment and fixtures.

2. Provide valves in at least the following locations:

a. In branches and/or headers of water piping serving a group of fixtures.

b. On both sides of apparatus and equipment.

c. For shutoff of risers and branch mains.

d. For flushing and sterilizing the system.

e. Where shown on the Drawings.

3. Locate valves for easy accessibility and maintenance.

N. Backflow Prevention:

1. Protect plumbing fixtures, faucets with hose connections, and other equipment having plumbing connection, against possible back-siphonage.

2. Arrange for testing of backflow devices as required by the governmental agencies having jurisdiction.

O. Plumbing Fixture Installation

1. Installation:

a. Set fixtures level and in proper alignment with respect to walls and floors, and with fixtures equally spaced.

b. Provide supplies in proper alignment with fixtures and with each other.

c. Provide flush valves in alignment with the fixture, without vertical or horizontal offsets.

2. Grout wall and floor mounted fixtures watertight where the fixtures are in contact with walls and floors.

3. Caulk deck-mounted trim at the time of assembly, including fixture and casework mounted. Caulk self-rimming sinks installed in casework.

P. Disinfection of Water Systems

1. Disinfect hot and cold water systems.

a. Notify the Architect at least 48 hours prior to start of the disinfection process.

b. Upon completion of disinfecting, secure and submit the Certificate of Performance required under Article 2a of this Section, stating system capacity, disinfectant used, time and rate of disinfectant applied and resultant residuals in ppm at completion.

c. Use disinfectant method approved by the California Plumbing Code.

2. When disinfection operation is completed, and after final flushing, secure an analysis by a laboratory, based on water samples from the system, showing test negative for coli-aerogene organisms. Provide a total plate count of less than 100 bacteria per cc, or equal to the control sample.

a. Upon completion of disinfecting, secure and submit the Certificate of Performance required by the County Health Dept, stating system capacity, disinfectant used, time and rate of disinfectant applied and resultant residuals in ppm at completion.

b. Use disinfectant method approved by the Owner.

3. If analysis results are not satisfactory, repeat the disinfection procedures and retest until specified standards are achieved.

Q. Other Testing and Adjusting.

1. Provide personnel and equipment, and arrange for and pay the costs of, all required tests and inspections required by governmental agencies having jurisdiction.

2. Where tests show materials or workmanship to be deficient, replace or repair as necessary, and repeat the tests until the specified standards are achieved.

3. Adjust the system to optimum standards of operation.

END OF SECTION

SECTION 23 08 00 - HEATING, VENTILATION, AND AIR CONDITIONING

PART 1 - GENERAL

1.1 The General Conditions apply to this section.

1.2 SCOPE
Furnish and install all heating, ventilating and air conditioning work indicated on the drawings and described herein. Also, any incidental work not shown or specified that is necessary to provide the complete system.

1.3 DRAWINGS

A. Examine all drawings prior to starting of work and report any discrepancies in writing to the Architect.

B. Verify all dimensions at the building site and check existing conditions before beginning work. Make changes which are necessary to install the work in harmony with other crafts; they shall be first approved by the Architect.

C. Execute work mentioned in the specifications and not shown on the drawings, or vice versa, the same as if specifically mentioned in both.

1.4 CODE RULES AND SAFETY ORDERS

A. Provide all work and materials in full accordance with the latest rules and regulations of the:

1. 2019 California Building Code
2. 2019 California Plumbing Code
3. 2019 California Mechanical Code
4. 2019 California Electrical Code
5. 2019 California Fire Code
6. Title 24, California Code of Regulations.

Nothing in these plans or specifications is to be construed to permit work not conforming to these codes. Furnish without extra charge, any additional material and labor required to comply with these rules and regulations.

1.5 FEE AND PERMITS:
Procure and pay for all licenses, fees and permits required.

1.6 UTILITY COORDINATION:
It shall be the contractor's responsibility to arrange and coordinate with the utility companies all requests for service(s) and the installation of meter(s) and services. The contractor shall furnish all documentation and information that the utility companies require prior to start of construction. Within 35 calendar days of the award of contract, the contractor shall submit to the architect a letter with copies of drawings that are sent to the utility companies for such services.

1.7 FRAMING, CUTTING AND PATCHING

Special framing, recesses, chases and backing for work of this section is covered under other sections. Be responsible for proper placement of all pipe sleeves, hangers and supports and location of openings for work of this section.

1.8 SUBSTITUTIONS AND MATERIALS LIST

A. Product names are used as qualitative standards, however other materials or methods shall not be used unless approved in writing by the architect. The burden of proof as to the equality of any proposed material shall be upon the contractor, and the architect's decision is final. Only one request for substitution shall be considered for each item. Equipment capacities specified are minimum acceptable.

B. Submit in indexed folders, five (5) sets of submittals for approval within 35 days after the award of the contract. The submittals shall be accompanied by equipment shop drawings, pump performance curves, and other pertinent data, showing the size, capacity and the proposed materials to be used. Submittals shall be provided, whether substitutions are made or not, and shall be listed in the order in which they appear in the schedules. Submittals shall be provided and approved prior to start of construction.

C. Any mechanical, electrical, structural or other changes required for the installation of any substituted equipment shall be made to the satisfaction of the architect and without additional cost to the owner. Approval by the architect of the substituted equipment and/or dimensional drawings does not waive these requirements. With submittal, provide drawings showing substituted equipment.

D. Approval of material shall not be construed as authorizing any deviations from the specifications unless the attention of the architect has been directed to the specific deviations.

E. Furnish to the Inspector, upon request, complete installation shop drawings of the same approved substitutions and drawings.

1.9 SITE CONDITIONS

Information on the drawings relative to existing conditions is approximate only. Deviations found necessary during progress of construction to conform to actual conditions, as approved by the architect, shall be made without additional cost to the owner. The contractor shall be held responsible for any damage caused to the existing property and services. Promptly notify the architect if services are found which are not shown on the drawings.

1.10 GUARANTEE

A. Repair or replace any defective work, material or part which may appear within one year of the date of acceptance. This shall include damage by leaks.

B. On failure to comply with the above guarantee within a reasonable length of time, after notification is given, the architect shall have the repairs made at the contractor's expense.

1.11 MAINTENANCE AND OPERATING INSTRUCTION

A. Furnish four complete sets of operating and maintenance instructions bound in a hardboard binder and indexed. Start compiling the data upon approval of list of materials, Final inspection will not be made until booklets are approved by the architect.

B. These sets shall incorporate the following:

1. Complete operating instructions for each item of equipment listing in detail the lubricants to be used, frequency of lubrication, inspections required, adjustments, etc.

2. Manufacturer's documentation with part numbers, instructions etc., for each item of equipment.

C. Post service telephone numbers and/or addresses in an appropriate place as designated by the architect.

1.12 RECORD DRAWINGS

A. Upon completion of the work, and as precedent to final payment, the contractor shall provide and deliver, to the architect, updated reproducible drawings showing the work exactly as installed.

PART 2 - PRODUCTS

2.1 Provide equipment as specified on the drawings

PART 3 - EXECUTION

3.1 MATERIAL STORAGE

A. During storage at the construction site, all duct and related air distribution component openings shall be covered with tape, plastic, sheetmetal or other methods acceptable to the local authority to reduce dust or debris collection in compliance with CalGreen section 5.504.3.

3.2 FILTERS

A. Air filters shall be of an approved type tested in accordance with test method SFM Std. 12-71-1 as shown in Part 12, Title 24, California Code of Regulations. Preformed filters having combustible framing shall be tested as a complete assembly. Air filters in all occupancies shall be Class 2 or better (as shown in the State Fire Marshall listing).

B. Provide temporary filters for all fans that are used during construction; after all construction dirt has been removed from the building, install new filters at no additional cost to the Owner.

C. Air filters shall be accessible for cleaning or replacement.

D. Filters shall be 1" thick Farr (MERV-8) or approved equal.

3.3 SHEET METAL WORK

A. Construct and install all sheet metal in accordance with the latest SMACNA recommendations. Provide variations in duct size, and additional duct fittings as required to clear obstructions and maintain clearances, as approved by the Architect, at no extra cost to the Owner. Pressure class shall be 2" w.c. or better.

B. Exterior ductwork shall be sealed water-tight with hardcast RTA 50 adhesive and DT-tape or Glenkote.

C. Interior ductwork shall be sealed water-tight with hardcast RTA 20 adhesive and DT-tape or Glenkote.

D. Duct sealer system must be installed in strict conformance with the manufacturer's application instructions.

E. Provide drive slip or equivalent flat seams for ducts where necessary due to spacer limitations. On ducts with flat seams, provide standard reinforcing inside of duct.

F. Provide Duro-Dyne Ventlon flexible connections on inlet and outlet of each fan.

G. Duct size shown on lined duct is the inside dimension.

H. All round ductwork shall be metal, except fiberglass flexible duct shall be used on the final 5'-0" connection to the diffuser in concealed areas. Transitions and bends to ductwork, to avoid obstructions, must be approved by the Architect. Protect ductwork from damage during and after erection until final inspection.

I. Flexible ducts shall conform the following requirements:

1. Factory-made air ducts shall be approved for the use intended or shall conform to the requirements of U.M.C. Standard No. 6-1. Each portion of a factory-made air duct system shall be identified by the manufacturer with a label or other suitable identification indicating compliance with U.M.C. Standard No. 6-1 and its class designation. These ducts shall be listed and shall be installed in accordance with the terms of their listing.

2. Flexible ducts shall consist of an exterior reinforced laminated vapor barrier, 1-1/2" thick fiber glass insulation (K=.25 @ 75^0F), encapsulated spring steel wire Helix and impervious, smooth, non-perforated interior vinyl liner. Individual lengths of flexible ducts shall contain factory fabricated steel connection collars.

3. Flexible ducts shall be supported at or near mid-length with 2” wide 28 GA. Steel hanger collar attached to the structure with an approved duct hanger. Installation shall minimize sharp radius turns or offsets. The maximum length connecting to terminal outlets shall be seven feet.

4. Flexible ducts may be used to cross seismic joints without offsets.

5. Flexible air ducts shall be anchored and supported per the latest SMACNA air duct annual.

3.4 GRILLES

A. Provide all outlets with gaskets and install so that there will be no streaking of the walls or ceiling due to leakage.

B. Furnish all diffusers, registers, and grilles with baked enamel finish—color to be coordinated with architect—and white gaskets on ceiling-mounted outlets.

C. All visible surfaces behind air outlet faces to be flat black.

3.5 VIBRATION ISOLATION

A. Isolate all ventilating and air conditioning equipment, including conduit, piping, duct, drains, etc., so that equipment will operate under continuous demand without objectionable vibrations.

3.6 TESTING AND BALANCING

A. Coordinate testing and balancing agency work with work of other trades.

B. Contractor shall provide for adjustments and/or additions or modifications to fan and motor sheaves, belts, damper linkages and the like to achieve proper air balance at no additional cost.

C. Testing and balancing shall be performed in complete accordance with AABC National Standards for Field Measurements and Instrumentation. Testing and balancing shall be performed on air distribution systems.

D. Balance air quantities of supply, return, outside air, and exhaust to achieve those given on Drawings with accuracy within minus 5 percent and plus 10 percent. Measure the total air quantity at each fan.

E. The air balance technician shall be responsible to modify all supply, return, and exhaust fan sheaves & VFD output frequency limits as applicable such that the design air flows are met. All supply fans controlled for filter loading shall similarly be modified to ensure the full range of motor power is available to the control system. Rated fan speed and motor speed shall not be exceeded.

END OF SECTION

SECTION 26 05 00 – COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes

1. Scope: The Section consists of general requirements and standard specifications for all work included under Division 26. Where specific specifications requirements of other Sections of Division 26 are in conflict with these General Requirements, those specific requirements shall govern.

   The project comprises the modernization of various areas of the facility as shown on the plans, including replacement of existing sub-panels, new lighting, new receptacles, connection of mechanical equipment and the modification/relocation of electrical devices and systems to accommodate the Architectural renovations.

   The electrical work shall consist of all electrical demolition activities required in association with the demolition activities contained in the Architectural, Mechanical or Structural plans or specifications, in addition to those activities specified on the electrical plans and specifications. Provide all conduits, devices, fittings, fixtures, panels, and related electrical equipment required for a complete and operating system. Provide all raceways for Mech. unit controls, including energy management system. Provide all line voltage (over 50 V.) wiring, low voltage wiring by Mech. or Controls Contractors. All existing and new raceways shall be concealed where possible, surface raceway routing shall be approved by the Architect prior to installation. Paint all exposed raceways, seal all penetrations and firestop all rated penetrations.

   The Contractor is reminded that this project is a remodel to an existing facility. Existing electrical systems have not been entirely verified and these drawings must be accepted with this understanding. Contractor shall verify all existing conditions at the site prior to bid. He shall further furnish labor and materials to achieve indicated results even though all details are not shown. No additional costs will be allowed for these items.

   Provide all labor, materials tools plant equipment, transportation and perform all operations necessary for the proper execution and completion of all "Electrical Work" whether specifically mentioned or not; all as indicated, specified herein, and/or implied thereby to carry out the apparent intent thereof.

B. Related work under this section

1. Labor and materials required to furnish and install the electrical systems in a complete and operational fashion.
2. Carpentry, masonry, steel and concrete materials and labor required for construction of proper stands, bases and supports for electrical materials and equipment.
3. Cutting and patching of holes required by installation including flashing and counterflashing of roof and exterior wall penetrations.
4. Excavating, pumping and backfilling required for installation.

5. Repair of damage to the premises resulting from construction activities under this Section to Owner's satisfaction.
6. Removal of work debris from construction activities to Owner's satisfaction.
7. Testing and cleaning of equipment installed.

C. Work not under this section

1. Furnishing of motors, fans, compressors, water heaters, thermostats and motor starters included under Division 15, or as noted otherwise.
2. Finish painting of exposed metal surfaces included under Division 9, or as otherwise noted.
3. Electrical Contractor shall provide connections to mechanical equipment where voltage exceeds 50 V and all necessary raceways for low voltage controls.

D. Related sections

1. Where items specified in other Division 26 sections conflict with the requirements of this Section, the most stringent requirement shall govern.
2. The requirements of this Section apply to all Division 26 work, as applicable.
3. Consult all other sections, determine the extent and nature of related work and properly coordinate work specified herein with that specified elsewhere to provide a complete and working installation.
    a. The General Conditions and General Requirements, Division 1, are a part of and are to apply to all the work of this Section.
    b. Site Construction –Division 2: Earthwork, Boring
    c. Concrete –Division 3: All sections
    d. Metals –Division 5: Structural Metal Framing
    e. Wood and Plastic –Division 6: Rough Carpentry
    f. Thermal and Moisture Protection – Division 7: Dampproofing and Waterproofing, Flashing, Fire and Smoke Protection
    g. Doors and Windows – Division 8: Access Doors
    h. Finishes – Division 9: Painting and Coatings
    i. Equipment – Division 11: As provided
    j. Special Construction – Division 13: As provided
    k. Conveying Systems –Division 14: As provided
    l. Mechanical –Division 15: Heat-Generation Equipment, Refrigeration Equipment, HVAC Equipment, HVAC Instrumentation and Controls

1.02 SUBMITTALS

A. Product Data

1. Prior to commencement of work and within 35 days after award of the contract, submit in ample time for approval in accordance with Division 1 a complete list of furnished equipment, material and shop drawings, including all substitutions.

Partial or incomplete lists of materials will not be considered. Substitutions will be considered thereafter.

a. Where it is in the best interest of Owner, Engineer may give written consent to a submittal received after expiration of designated time limits or for an additional re-submittal.

2. Substitutions

a. If it is desired to make a substitution, submit complete information or catalog data to show equality of equipment or material offered to that specified. Substitutions will be interpreted to be all manufacturers other than those specifically listed by model or catalog number. No substitution will be allowed unless requested and approved in writing. Materials of equal merit and appearance, in the opinion of Architect and Engineer, will be approved for use. Architect and Engineer reserve the right to require originally specified items at no additional costs to Owner. Only one request for substitutions will be considered on each item of material or equipment.

b. Acceptance of a substitute is not to be considered a release from the Specifications. Correct any deficiencies in an item, even though approved at the Contractor's expense.

c. Responsibility for installation of approved substitution is included herein. Make any changes required for installation of approved substituted equipment without additional costs.

d. Failure to comply with any of the requirements of the above will necessitate that the specified materials be submitted and supplied.

B. Change Order Proposals

1. Shall comply with the requirements set forth by the General Conditions

2. All change order proposals and change orders, both additive and deductive, shall be accompanied by a detailed materials and labor breakdown for each specific task and/or item. The breakdown shall include actual materials costs plus overhead and profit, as well as labor units based upon the most recent NECA (National Electrical Contractors Association) Manual of Labor Units (NECA Index #4090) or equivalent publication for each specific task and item. Labor costs shall be computed as outlined within the General Conditions.

C. Closeout submittal

1. Furnish three complete sets of maintenance and operating instructions bound in a binder and indexed to Owner. Start compiling data upon approval of materials and equipment. Final inspection will not be made until Engineer approves binders. Refer also to Section 1 for additional requirements.

2. Provide one of each tool required for proper equipment operation and maintenance provided under this Section. All tools shall be delivered to the Owner at project completion.

3. Provide two keys to Owner for each lock furnished under this Section.

4. Record drawings

a. Upon completion of Work, furnish Engineer with complete sets of plans (not marked blueprints) upon which shall be shown all work installed under

Contract, which are not in accordance with the Construction Documents. Refer to Division 1 requirements.

b. All symbols and designations used in preparing the Record Drawings shall match those used in the Construction Documents.

1.03 QUALITY ASSURANCE

A. References to codes, standards, specifications and recommendations of technical societies, trade organizations and governmental agencies shall mean that latest edition of such publications adopted and published prior to bid submittal. Such codes or standards shall be considered a part of this Specification as though fully repeated herein.

B. Work and materials shall be in full accordance with the latest rules and regulations of applicable state of local laws or regulations and standards of following:

1. National Fire Protection Association (NFPA)
2. California Electrical Code (CEC)
3. California Occupational Safety Health Act (Cal-OSHA)
4. California State Fire Marshall (CSFM)
5. California Code of Regulations (CCR)
6. Electrical Safety Orders, CAC Title 8 (ESO)
7. California Public Utilities Commissions, General Order 95 (GO-95)
8. Applicable rules and regulations of local utility companies.
9. NECA 1-2000, Standard Practices for Good Workmanship in Electrical Contracting

C. Nothing in the Construction Documents shall be construed to permit work not conforming to these Codes. Whenever the indicated material, workmanship, arrangement or construction is of high quality or capacity than that required by the above rules and regulations, the Construction Documents shall take precedence. Should there be any direct conflict between the rules and regulations and Construction Documents, the rules shall govern.

D. All electrical equipment and material furnished under this Section shall conform to NEMA and ASTM standards, CEC and bear the Underwriters' Laboratories (UL) label where such label is applicable.

E. Follow manufacturer's direction where these direction cover points not included with the Construction Documents.

1.04 DELIVERY, STORAGE AND HANDLING

A. Packing, shipping, handling and unloading

1. Damage to the equipment delivered to the site or in transit to the job shall be the responsibility of the Electrical Contractor.
2. Equipment and material delivery of shall be scheduled as required for timely, expeditious progress of Work.

B. Storage and protection

1. Storage and protection of job equipment is the responsibility Contractor.

C. Waste management and disposal

1. Comply with Division 1 requirements with regards to waste management and disposal.

1.05 PROJECT CONDITIONS

A. Discrepancies

1. In the event of discrepancies with the Contract Documents, Engineer shall be notified with sufficient time as stated within Division 1 to allow the issuing of an addendum prior to the bid opening.

2. If, in the event that time does not permit notification of clarification of discrepancies prior to the bid opening, the following shall apply:

a. The drawings govern in matters of quantity and specifications govern in matters of quality.

b. In the event of conflict within the drawings and specifications involving quantities or quality, the greater quantity or higher quality shall apply. Such discrepancies shall be noted and clarified within the contractor's bid. No additional allowances will be made because of errors, ambiguities or omissions which reasonably should have been discovered during the bid preparation.

B. Verify all power and communication utilities' requirements prior to commencement of any utility work. Make proper adjustments to the construction to satisfy the serving utility.

C. Information shown relative to services is based upon available records and data, but shall be regarded as approximate only. Make minor deviations found necessary to conform with actual locations and conditions without extra cost. Verify locations and elevations of utilities prior to commencement of excavation for new underground installation.

D. Exercise extreme care in excavating near existing utilities to avoid any damage thereto; be responsible for any damage caused by such operations. Contact all utility companies to obtain exact locations prior to commencement of construction.

E. The electrical plans indicate the general layout and arrangement; the architectural drawings and field conditions shall determine exact locations. Field verify all conditions and modify as required to satisfy design intent. Maintain all required working clearances.

F. Fees, permits and utility services

1. Obtain and pay for all permits and service charges required for the installation of this work. Arrange for required inspections and secure approvals from authorities having jurisdiction. Arrange for all utility connections and pay charges incurred including excess service charges if any.

2. Extra charges imposed by the electrical and communication utility companies shall be included in the bid, if available. Unless otherwise stated, these charges will be assumed included in the bid.

G. Provide and maintain temporary construction power. The General Contractor will pay for electric energy charges; refer to Division 1 for details. Should the Electrical Contractor be the prime contractor, the Electrical Contractor shall pay for energy charges.

1.06 SEQUENCING

A. Coordinate work within phasing plans as provided by the Owner.

1.07 WARRANTY

A. Furnish one-year guarantee in accordance with and in form required under Division 1. Repair or replace as may be necessary any defective work, material, or part without cost to the Owner, include repair or replacement of other work, furnishing, equipment or premises caused by such repair or replacement of defective work.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Materials mentioned herein or on Drawings require that the items be provided and of quality noted or an approved equal. All materials shall be new, full weight, standard in all respects and in first-class condition. Insofar as possible, all materials used shall be of the same brand or manufacturer throughout for each class of material or equipment.

B. Trade names or catalog numbers stated herein indicts grade or quality of material desired. Materials, where applicable, shall UL labeled and in accordance with NEMA standards.

C. Dimensions, sizes and capacities shown are a minimum. Do not make changes without permission or Engineer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine Construction Documents and Site; be familiar with types of construction where electrical installation is involved. Note carefully other sections of Specifications with their individual cross-references, standard details, etc. Any electrical work or materials shown either in Construction Documents, but not mentioned herein, or vice versa, shall be executed the same as if mentioned herein, in a workmanlike manner in accordance with NEMA Standards of Installation. Coordinate work with other crafts to avoid conflicts, and check all outlet locations with Architectural and Mechanical drawings and specifications. Make minor

adjustments without additional cost to Owner. Engineer will make clarifications and rulings concerning any obvious discrepancies or omissions in work prior and after bidding. Perform all work involved in correcting obvious errors or omissions after award of Contract as directed by Engineer at Contractor's expense.

B. Examine site dimensions and locations against Drawings and become informed of all conditions under which work is to be done before submitting proposals. No allowance will be made for extra expense due to error.

C. Layouts of equipment, accessories and wiring systems are diagrammatic (not pictorial), but shall be followed as closely as possible. Construction Documents are for assistance and guidance, and exact locations, distance, levels, etc., will be governed by construction; accept same with this understanding.

D. Horsepower of motors or wattage of equipment indicated in Construction Documents is estimated horsepower or wattage requirement of equipment furnished under other sections of Specifications. Size all feeders (conduit and wiring), motor starters, overload protection and circuit breakers to suit horsepower of motors or wattage of equipment actually furnished under various sections of specifications. However, in no case shall feeders and branch circuits (conduit and wiring) and circuit breakers be of smaller capacities or sizes than those indicated on Drawings or specified, unless approved in writing by Engineer.

3.02 PREPARATION

A. Sealant

1. Seal all exterior wall penetrations in an approved watertight manner and to the satisfaction of Engineer and Architect.

B. Rust inhibitor

1. Channels, joiners, hangers, caps, nuts and bolts and associated parts shall be plated electrolytically with zinc followed immediately thereafter by treating freshly deposited zinc surfaces with chromic acid to obtain a surface which will not form a white deposit on surface for an average of 120 hours when subjected to a standard salt spray cabinet test, or shall be hot dipped galvanized

3.03 INSTALLATION

A. Equipment identification

1. Properly identify panelboards, remote control switches, push buttons, terminal boxes, etc. with a descriptive nameplate. Make nameplate with 3/32” laminated plastic with black background and white letters. Machine engraved letters 1/8” high for equipment in device box(es) and 1/4” high for panelboards, terminal cabinets or larger items. Punched strip type nameplates and cardholders in any form are not acceptable. Fasten nameplates with oval head machine screws, tapped into front cover/panel.

B. Working space

1. Provide adequate working space around electrical equipment in compliance with Article 4 of Electrical Safety Orders and NEC Article 110. In general provide 78” of headroom and 30” wide minimum clear workspace in front of panelboards and

controls. In addition to the above, provide the following minimum working clearances:

a. 0V – 150V (line-to-ground) provide 36” minimum clear distance.

b. 151V – 600V (line-to-ground) provide 42” minimum clear distance.

C. Equipment supports

1. Anchor all electrical equipment to structure. Support systems shall be adequate to withstand seismic forces.

D. Excavating and backfilling

1. Excavate and backfill as required for installation of Work. Restore all surfaces, roadways, walks, curbs, walls existing underground installations, etc., cut by installations to original condition in an acceptable manner. Maintain all warning signs, barricades, flares and lanterns as required by ESO and local ordinances.

2. Dig trenches straight and true to line and grade, with bottom clear of any rock points. Support conduit for entire length on undisturbed original earth. Minimum conduit depth of pipe crown shall be 2’ below finished or natural grade.

E. Forming, cutting and patching

1. In new construction, General Contractor shall provide any special forming, recesses, chased, etc., and provide wood blocking, backing and grounds as necessary for the proper installation of Electrical work. Be responsible for notifying General Contractor that such provision is necessary; layout work and check to see that it suits his requirements.

a. Provide metal backing plates, anchor plates and such that are required for anchorage of Electrical work under this Section; securely weld or bolt to metal framing. Wood blocking or backing will not be permitted in combination with metal framing.

2. Be responsible for proper placement of pipe sleeves, hangers, inserts and supports for this Work.

F. Concrete work

1. Provide concrete work related solely to Electrical work. Concrete work, including forming and reinforcing steel installed under this Division, shall comply with all applicable requirements of Division 1, or in accordance with the State of California Standard Specifications issued by the Department of Transportation.

3.04 REPAIR/RESTORATION

A. Cutting, patching and repairing of existing construction to permit installation of Work is the responsibility of this Section. Repair or replace all damage to existing work in kind to Owner’s satisfaction.

B. Obtain Engineer’s approval prior to performing any cutting or patching of concrete, masonry, wood or steel structure within building.

3.05 FIELD QUALITY CONTROL

A. Inspection of work

1. Working parts shall be readily accessible for inspection, repair and renewal. The right is reserved to make reasonable changes in equipment location shown on Drawings prior to rough in without additional costs to the Owner.
2. During construction all work will be subject to observation by the Engineer and his representatives. Assist in ascertaining any information that maybe required.
3. Do not allow or cause any work installed hereunder to be covered up or enclosed before it has been inspected and approved. Should any work be enclosed or covered prior to approval, uncover work, and after it has been inspected and approved, restore work of all others to the condition in which it was found at the time of cutting, all without additional costs to Owner.

B. Furnish all testing equipment as maybe required.

C. Test all wiring and connections for continuity and grounds; where such test indicates faulty insulation or other defects, locate, repair and re-test.

D. Check rotation of all motors and correct if necessary.

3.06 CLEANING

A. Repair or replace all broken, damaged or otherwise defective parts without additional cost to Owner, and leave entire work in a condition satisfactory to Engineer. At completion, carefully clean and adjust all equipment, fixtures and trim installed as part of this work; leave systems and equipment in satisfactory operating condition.

B. Clean out and remove from the site all surplus materials and debris resulting from this work; this includes surplus excavated materials.

3.07 DEMONSTRATION

A. At project completion, Contractor shall allot a period of not less than 8 hours for instruction of operating and maintenance personnel in the use of all systems installed under this Section. This time is in addition to any instruction time stated in the Specifications of other sections for other equipment, i.e., fire alarm, security, intercom, etc. All personnel shall be instructed at one time, the Contractor shall make all necessary arrangements with manufacturer’s representatives as may be required. Contractor, if any, for the above services shall pay all costs.

3.08 PROTECTION

A. In performance of work, protect work of other trades as well as work under this Section from damage. Protect electrical equipment, stored and installed, from dust, water or other damage.

END OF SECTION

SECTION 26 05 19 – LOW-VOLTAGE POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes

1. Provide all labor, materials and equipment necessary for the installation of all conductors and cables under this Section related to lighting, power, mechanical, control, and signal systems.

B. Related sections

1. Where items specified in other Division 26 sections conflict with the requirements of this Section, the most stringent requirement shall govern.
2. The requirements of this Section apply to all Division 26 work, as applicable.
3. Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified:

1. ASTM -American Society for Testing and Materials
   a. B3; Standard Specification for Soft or Annealed Copper Wire
   b. B8; Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
   c. B787/B787M; Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation
   d. D1000; Standard Test Method for Pressure-Sensitive Adhesive-Coated Tapes Used for Electrical and Electronic Applications
2. CCR –California Code of Regulations, Title 24
   a. Part 3 -California Electrical Code(CEC); NFPA 70 National Electrical Code (NEC) with California amendments
3. UL -Underwriters Laboratories, Inc.
   a. UL 83; Thermoplastic-Insulated Wire and Cables
   b. UL 486A 486B; Wire Connectors
   c. UL 486C; Splicing Wire Connectors
   d. UL 486D; Standard for Insulated Wire Connector Systems for Underground Use or In Damp or Wet Locations
   e. UL 486E; Standard for Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors

f. UL 493; Thermoplastic-Insulated Underground Feeders and Branch Circuit Cables

g. UL 510; Standard for Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape

h. UL 854; Service-Entrance Cables

4. NEMA –National Electrical Manufacturer's Association

a. WC 70-1999; Nonshielded Power Cables Rated 2000 Volts or less for the Distribution of Electrical Energy

5. IEEE –Institute of Electrical and Electronic Engineers

a. 82; Standard Test Procedure for Impulse Voltage Tests on Insulated Conductors

1.03 SUBMITTALS

A. Submit manufacturer's data for equipment and materials specified within this Section in accordance to Section 26 05 00.

1.04 DELIVERY

A. Wire shall be in original unbroken package. Obtain approval of Inspector or Engineer before installation of wires.

PART 2 - PRODUCTS

2.01 BUILDING WIRE

A. Conductor material

1. Provide annealed copper for all wire, conductor and cable of not less than 98% conductivity.

2. Wire #8 AWG and larger shall be stranded.

3. Wire #10 AWG and smaller shall be solid.

B. Insulation material

1. All insulated wire, conductor and cable shall be 600 Vac rated.

2. Feeder and branch circuits larger than #6 AWG shall be type THW, XHHW or THHN/THWN.

3. Feeder and branch circuits #6 AWG and smaller shall be type TW, THW, XHHW or THHN/THWN.

4. Control circuits shall be type THW or THHN/THWN.

5. Wires shall bear the UL label, be color-coded and marked with gauge, type and manufacturer's name on 24" centers.

2.02 METAL-CLAD CABLE (MC CABLE)

A. MC cable shall be an armored assembly of two or more dual rated THHN/THWN conductors and a full sized green insulated grounding conductor.

B. MC cable shall be fabricated in continuous lengths from galvanized steel strip, spirally would and formed to provide an interlocking design.

C. Fitting connectors shall be of the single screw clamp variety with steel or cast malleable iron bodies and threaded male hubs with insulated throats. Fittings shall be UL listed for use with MC cable type specified.

2.03 FLEXIBLE CORDS AND CABLES

A. Provide flexible cords and cables of size, type and arrangement as indicated on Drawings.

B. Type S flexible cords and cable shall be manufactured in accordance with NEC Article 400 and composed of two or more conductors and a full sized green insulated grounding conductor with an outer rubber or neoprene jacket.

C. Flexible cords and cables shall be fitted with wire mesh strain relief grips either as an integral connector component or an independently supported unit.

D. Suspended flexible cords and cables shall incorporate safety spring(s).

2.04 WIRE CONNECTIONS AND TERMINATIONS

A. Electrical spring wire connectors

1. Provide multi-part construction incorporating a non-restricted, zinc coated square cross-sectional steel spring enclosed in a steel sheet with an outer jacket of plastic and insulating skirt.

2. Self-striping pigtail and tap U-contact connectors are not acceptable.

B. Compression type terminating lugs

1. Provide tin-plated copper high compression type lugs for installation with hand or hydraulic crimping tools as directed by manufacturer. Notch or single point type crimps are not acceptable.

2. Two hole, long barrel lugs shall be provided for size #4/O AWG and larger wire where terminated to bus bars. Use minimum of three crimps per lug where possible.

C. Splicing and insulating tape

1. Provide black, UV resistant, self extinguishing, 7 mil thick vinyl general purpose electrical tape per UL 510 and ASTM D1000. 3M Scotch 33 or equal.

D. Insulating putty

1. Provide pads or rolls of non-corrosive, self-fusing, 125 mil thick rubber putty with PVC backing sheet per UL 510 and ASTM D1000. 3M Scotchfil or equal.

E. Insulating resin

1. Provide two-part liquid epoxy resin with resin and catalyst in pre-measured, sealed mixing pouch. 3M Scotchcast 4 or equal.
2. Use resin with thermal and diaelectric properties equal to the cable's insulating properties.

F. Terminal strips

1. Provide box type terminal strips in the required quantities plus 25% spare. Install in continuous rows.
2. Use the box type terminal strips with barrier open backs and with ampere ratings as required.
3. Identify all terminals strips and circuits.

G. Crimp type connectors

1. Provide insulated fork or ring crimp terminals with tinned electrolytic copper-brazed barrel with funnel wire entry and insulation support.
2. Fasten crimp type connectors or terminals using a crimping tool recommended by the manufacturer.
3. Provide insulated overlap splices with tinned seamless electrolytic copper-brazed barrel with funnel wire entry and insulation support.
4. Provide insulated butt splices with tinned seamless electrolytic copper-brazed barrel with center stop, funnel wire entry and insulation support.

H. Cable ties

1. Provide harnessing and point-to-point wire bundling with nylon cable ties. Install using tool supplied by manufacturer as required.

I. Wire lubricating compound

1. UL listed for the wire insulation and conduit type, and shall not harden or become adhesive.
2. Shall not be used on wire for isolated type electrical power systems.

J. Bolt termination hardware

1. Bolts shall be plated, medium carbon steel heat-treated, quenched and tempered equal to ASTM A-325 or SAE Grade 5; or silicon bronze alloy ASTM B-9954 Type B.
2. Nuts shall be heavy semi-finished hexagon, conforming to ANSI B18.2.2, threads to be unified coarse series (UNC), class 2B steel or silicon bronze alloy.
3. Flat washers shall be steel or silicon bronze, Type A plain standard wide series, conforming to ANSI B27.2. SAE or narrow series shall be used.
4. Belleville conical spring washers shall be hardened steel, cadmium plated or silicon bronze.
5. Each bolt connecting lug(s) to a terminal or bus shall not carry current exceeding the following values:
   a. 1/4" bolt – 125 A

b. 5/16” bolt – 175 A

c. 3/8” bolt – 225 A

d. 1/2” bolt – 300 A

e. 5/8” bolt – 375 A

f. 3/4” bolt – 450 A

2.05 MANUFACTURED WIRING SYSTEM (MWS)

A. Manufacturer shall be American Cable System or approved equal.

B. The MWS shall be complete, including all tap boxes, cable sets, tap cables, lighting fixture adapter assemblies and all accessories.

C. The system shall be constructed such that all system components will be metal encased, forming a fully grounded system. All spare and unused connectors in the system shall be covered with caps provided for the purpose. System shall be UL listed for use within plenums and spaces used for environmental air.

D. Cable assembly

1. All cables shall have factory pre-wired connectors. Cable sets shall have a power-in connector on one end and a power-out connector on the opposite end. Tap cables shall have a power-in connector on one end and 6” pigtail leads on the opposite end for field termination with transition and switch boxes.

2. Each cable shall have a positive means to engage the connectors in system components such as distribution boxes, tap boxes and lighting fixtures.

3. The cable shall be clearly marked and color-coded for designation of service and voltage.

4. Line voltage branch circuit cable sets shall have #12 AWG minimum copper conductors rated at 600 Vac, plus fully rated equipment grounding conductor within a galvanized steel armor interlocking sheath**.**

E. Connectors

1. The connectors shall be polarized that only units of the same service, voltage and function can be physically mated and electrically connected.

F. Adapter assemblies (Lighting fixture)

1. The MWS manufacturer shall furnish adapter assemblies directly to the light fixture manufacturer for installation in all fixtures to be connected to this system.

2. Lighting fixtures shall be factory pre-wired with manufactured wiring system assemblies furnished under this Section and shall be shipped to the job site ready for installation.

3. Adapter assemblies shall be manufactured such that the adapter uses the standard fixture’s knockouts.

4. Adapter assemblies shall be UL listed components. The manufacturers shall be responsible for obtaining UL listed for the entire assembly.

G. Tap boxes

1. All tap boxes shall be complete with provisions for interface unit, conduit entry and mounting.
2. All box connectors (interface units) shall be pre-wired with color coded #12 AWG, 600 Vac phase, neutral and equipment grounding conductors.
3. Interface units shall be power-out type, uniquely polarized for service and function. The connector shall receive the cable heads by a positive means.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Thoroughly examine site conditions for acceptance of wire and cable installation to verify conformance with manufacturer and specification tolerances. Do not commence with work until all conditions are made satisfactory.

3.02 INSTALLATION

A. All wire, conductor, and cable with their respective connectors, fittings and supports shall be UL listed for the installed application and ambient conditions.

B. Feeders and branch circuits in wet locations shall be rated 75°C minimum.

C. Feeders and branch circuits in dry locations shall be rated 90°C minimum.

D. Minimum conductor size

1. #12 AWG copper for all power and lighting branch circuits.
2. #14 AWG copper for all line voltage signal and control wiring, unless otherwise indicated.
3. Aluminum conductors may be substituted on the basis of equal performance for sizes greater than #10 AWG with the approval of Engineer.

E. Remove and replace conductors under the following conditions at no additional costs to the Owner:

1. Installed within wrong specified conduit or raceway.
2. Damaged during installation.
3. Of insufficient length to facilitate proper splice of conductors

3.03 WIRING METHODS

A. Install wires and cable in accordance with manufacturer’s written instructions, as shown on Drawings and as specified herein.

B. Install all single conductors within raceway system, unless otherwise indicated.

C. Parallel circuit conductors and terminations shall be equal in length and identical in all aspects.

D. Provide adequate length of conductors within electrical enclosures and neatly train to termination points with no excess. Terminate such that there is no bare conductor at the terminal.

E. Splice cables and wires only in junction boxes, outlet boxes, pull boxes, manholes or handholes.

F. Group and bundle with tie wrap each neutral with its associated phase conductors where more than one neutral conductor is present within a conduit.

G. Install cable supports for all vertical feeders in accordance with NEC Article 300. Provide split wedge type fittings, which firmly clamp each individual cable and tighten due to cable weight.

H. Seal cable where exiting a conduit from an exterior underground raceway with a non-hardening compound (i.e., duct seal or equal).

I. Provide UL listed factory fabricated, solder-less metal connectors of size, ampacity rating, material, type and class for applications and for services indicated. Use connectors with temperature ratings equal or greater than the conductor or cable being terminated.

J. Stranded wire shall be terminated using fittings, lugs or devices listed for the application. Under no circumstances shall stranded wire be terminated solely by wrapping it around a screw or bolt.

K. Flexible cords and cables supplied as part of a pre-manufactured assembly shall be installed according to manufacturer's published instructions.

3.04 WIRING INSTALLATION IN RACEWAYS

A. Install wire in raceway after interior of building has been physically protected from weather, and all mechanical work likely to injure conductors has been completed.

B. Pull all conductors into raceway at the same time.

C. Use UL listed, non-petroleum base and insulating type pulling compound as needed.

D. Completely mandrel all underground or concrete encased conduits prior to installation.

E. Completely and thoroughly swab raceway system prior to installation

F. Do not use block and tackle, power driven winch or other mechanical means for pulling conductors smaller than #1 AWG.

G. Wire pulling

1. Provide installation equipment that will prevent cutting or abrasion of insulation during installation.

2. Maximum pull tension shall not exceed manufacturer's recommended value during installation for cable being measured with tension dynometer.

3. Use rope made of non-metallic material for pulling.

4. Attach pulling lines by means of either woven basket grips or pulling eyes attached directly to the conductors.

5. Pull multiple conductors simultaneously within same conduit.

3.05 MC CABLE INSTALLATION

A. MC cable shall be installed where clearly indicated on Drawings or with explicit, written permission by Engineer or Owner.

B. Install MC cable in accordance with manufacturer's instructions and NEC Article 334. Follow manufacturer's instruction when connecting the cable to fittings and boxes. Connectors and boxes shall be firmly secured to the cable, but not over-tightened.

C. Support cable every 6 feet and with 12 inches of boxes per NEC Article 334 using separate spring clip or metal cable ties (not steel tie wire) for each cable. Do not bundle cables together.

D. Install separate drop wires above accessible, tile ceilings.

E. Do not rest cables on ceiling tiles or allow contact with metal piping systems.

F. Provide separate sleeves and/or fire barriers where cables penetrate firewalls, unless cable is UL listed for the application.

3.06 MANUFACTURED WIRING SYSTEM (MWS) INSTALLATION

A. MWS shall be installed where clearly indicated on Drawings or with explicit, written permission by Engineer or Owner.

B. Install MWS in accordance with manufacturer's instructions and NEC Article 334.

C. System shall be furnished complete with all accessories and hardware required for a completely operational system.

D. Support cable every 6 feet and with 12 inches of boxes per NEC Article 334 using separate spring clip or metal cable ties (not steel tie wire) for each cable. Do not bundle cables together.

E. Provide supports for all system boxes per the requirements of this Division.

F. Install separate drop wires above accessible, tile ceilings.

G. Do not rest cables on ceiling tiles or allow contact with metal piping systems.

H. Where switches are shown in areas using MWS, provide the following:

1. Provide conduit and all necessary conductors from the switch location to a MWS tap box.

2. MWS tap box shall be located above accessible ceiling near switches or controlled lighting fixtures.

I. Mark each connector, cable and box with circuit number(s) being supplied.

3.07 WIRE SPLICES, JOINTS AND TERMINATIONS

A. Join and terminate wire, conductors and cables in accordance with UL 486, NEC and manufacturer's instructions.

B. Thoroughly clean wires before installing lugs and connectors.

C. Make splices, taps and terminations to carry full conductor ampacity without perceptible temperature rise, and shall be made mechanically and electrically secure.

D. Terminate wires in terminal cabinets using terminal strips, unless otherwise indicated.

E. Insulate spare conductors with electrical tape and leave sufficient length to terminate anywhere within panel or cabinet.

F. Encapsulate splices in wet locations using specified insulating resin kits.

G. Make up all splices and taps in accessible junction or outlet boxes with connectors as specified herein. Pigtails and taps shall be the same color as feed conductor with at least 6 inches of tail, all neatly packed within box.

H. Where conductors are to be connected to metallic surfaces, coated surfaces shall be cleaned to base metal surface before installing connector. Remove lacquer coating of conduits where ground clamps are to be installed.

I. Branch circuits (#10 AWG and smaller) connectors shall comply with 2.01.D.2 and 2.01.D.2 above.

J. Branch circuits (#8 AWG and larger)

1. Join or tap conductors using insulated mechanical compression taps with pre-molded, snap-on insulating boots or specified conformable insulating pad and over-wrapped with two half-lapped layers of vinyl insulating tape starting and ending at the middle of joint.

2. Terminate conductors using mechanical compression lugs in accordance with manufacturer's recommendation or as specified elsewhere.

3. Field installed compression connectors for 250 MCM and larger shall have not less than two clamping elements or compression indents per wire.

4. Insulate splices and joints with materials approved for the particular use, location, voltage and temperature.

K. Termination hardware assemblies

1. Al/Cu lugs connected to aluminum plated or copper bus shall be secured with steel bolt, flat washer (two per bolt), Belleville washer and nut.

2. Copper lugs connected to copper buss shall bus shall be secured using silicon bronze alloy bolt, flat washer (two per bolt), Belleville washer and nut.

3. The crown of Belleville washers shall be under the nut.

4. Bolt assemblies shall be torque to manufacturer's recommendations. Where manufacturer recommendation is not obtainable, the following shall be used:

a. 1/4" -20 bolt at 80 inch-pound torque

b. 5/16" -18 bolt at 180 inch-pound torque

c. 3/8" -20 bolt at 20 inch-pound torque

d. 1/2" -20 bolt at 40 inch-pound torque

e. 5/8" -20 bolt at 55 inch-pound torque

f. 3/4" -20 bolt at 158 inch-pound torque

3.08 IDENTIFICATION

A. Securely tag all branch circuits. Mark conductors with specified vinyl wrap-around markers. Where more than two conductors run through a single outlet, mark each conductor with the corresponding circuit number.

B. Provide all terminal strips with each individual terminal identified using specified vinyl markers.

C. In manholes, pullboxes and handholes provide tags of embossed brass type with cable type and voltage rating. Attach tags to cable with slip-free plastic cable lacing units.

D. Color coding

1. For 120/208 Volt (or 120/240 Volt), 1 phase, 3 wire systems:
    a. Phase A – Black
    b. Phase B – Red
    c. Neutral – White
    d. Ground – Green
2. For 120/208 Volt, 3 phase, 4 wire systems:
    a. Phase A – Black
    b. Phase B – Red
    c. Phase C – Blue
    d. Neutral – White
    e. Ground – Green
3. For 277/480 Volt, 3 phase, 4 wire systems:
    a. Phase A – Brown
    b. Phase B – Orange
    c. Phase C – Yellow
    d. Neutral – Gray
    e. Ground – Green
4. Switch leg individually installed shall be the same color as the branch circuit to which they originate, unless otherwise indicated.
5. Travelers for 3-way and 4-way switches shall be a distinct color and pulled with the circuit switch leg or neutral.

3.09 FIELD QUALITY CONTROL

A. Supply labor, materials and test equipment required to perform continuity and ground tests.

B. Electrical testing

1. Perform feeder and branch circuit insulation test after installation and prior to connection to device.
2. Tests shall be performed by 600 Vdc megger for a continuous 10 seconds from phase-to-phase and phase-to-ground.
3. Torque test conductor connections and terminations for conformance to Specifications.
4. If any failure is detected, locate failure, determine cause and replace or repair cable to Engineer's satisfaction at no additional costs.
5. Furnish test results in type written report form for review by Engineer.

END OF SECTION

SECTION 26 05 26 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes

1. Provide all labor, materials and equipment necessary to complete the installation required for the item specified under this Section, including but not limited to power system grounding

B. Related sections

1. Where items specified in other Division 26 sections conflict with the requirements of this Section, the most stringent requirement shall govern.
2. The requirements of this Section apply to all Division 26 work, as applicable.
3. Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified:

1. CCR –California Code of Regulations, Title 24
   a. Part 3 -California Electrical Code(CEC); NFPA 70 National Electrical Code (NEC) with California amendments
2. IEEE –Institute of Electrical and Electronic Engineers
   a. 142; Recommend Practices for Grounding of Industrial and Commercial Power Systems
3. NFPA –National Fire Protection Association
   a. 780; Lightning Protection Code
4. UL –Underwriters Laboratories, Inc.
   a. 467; Grounding and Bonding Equipment

1.03 SYSTEM DESCRIPTION

A. This Section provides for the grounding and bonding of all electrical and communication apparatus, machinery, appliances, components, fittings and accessories where required to provide a permanent, continuous, low impedance, grounded electrical system.

B. Ground the electrical service system neutral at service entrance equipment as shown on the Drawings.

C. Ground each separately derived system, as defined in CEC/NEC 250-5(d) and on the Drawings, unless specifically noted otherwise.

D. Except as otherwise indicated, the complete electrical installation including the neutral conductor, equipment and metallic raceways, boxes and cabinets shall be completely and effectively grounded in accordance with all CEC/NEC requirements, whether or not such connections are specifically shown or specified.

1.04 SUBMITTALS

A. Submit manufacturer's data for equipment and materials specified within this Section in accordance to Section 26 05 00.

1.05 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the materials specified herein shall be new and unused, bearing UL labels where applicable.

PART 2 - PRODUCTS

2.01 CONCRETE ENCASED GROUNDING ELECTRODE (UFER GROUND)

A. #3/O AWG minimum bare stranded copper conductor.

2.02 DRIVEN (GROUND) RODS

A. Copper clad steel, minimum ¾" diameter by 10'-0" length, sectional type with copper alloy couplings and carbon steel driving stud; Weaver, Cadweld or equal.

2.03 INSULATED GROUNDING BUSHINGS

A. Plated malleable iron body with 150°C molded plastic insulated throat and lay-in ground lug; OZ/Gedney BLG, Thomas & Betts #TIGB series or equal.

2.04 CONNECTION TO PIPE

A. Cable to pipe connections; OZ/Gedney G-100B series, Thomas & Betts #290X series or equal.

2.05 CONNECTIONS TO STRUCTURAL STEEL, GROUND RODS OR SPICES

A. Where required by the Drawings, grounding conductors shall be spliced together, connected to ground rods or connected to structural steel using exothermic welds, Cadweld or equal, or high pressure compression type connectors, Cadweld, Thomas & Betts or equal.

2.06 BONDING JUMPERS

A. OZ/Gedney Type BJ, Thomas & Betts #3840 series or equal.

2.07 GROUND CONDUCTOR

A. Ground conductor shall be code size UL labeled, Type THWN insulated copper wire, green in color.

2.08 MAIN BUILDING REFERENCE GROUND BUS (BGB)

A. Provide 1 24”x4”x1/4” TK copper bus bar mounted on wall with insulating stand-offs at +18” AFF. Furnish complete with cast copper alloy body Thomas Betts Series 310 or equal lugs for connecting grounding conductors. Attach lugs to bus with appropriate size bronze bolt, flat washer and Belleville washer. All connections shall be torque, and all holes shall be drilled and tapped for single hole lugs. Provide 4 spare lugs with respective spaces.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Grounding electrodes

1. Concrete encased grounding electrode (Ufer ground)

a. Provide a #3/O AWG minimum bare copper conductor encased along the bottom of concrete foundation, footing or trench which is in direct contact with the earth and where there is no impervious waterproofing membrane between the footing and soil. The electrode shall extend through a horizontal length of 30’ minimum and shall be encased in not less than 2” or more than 5” of concrete separating it from surrounding soil. The electrode shall emerge from the concrete slab through a protective non-metallic sleeve and shall be extended to BGB or as shown on Drawings.

2. Supplementary grounding electrode (ground ring, grid and driven rod)

a. Provide as shown driven ground rod(s). Interconnect ground rod with structural steel and adjacent rods with code size bare copper conductor. Ground rods shall be space no less than 6’-0” on centers from any other electrode or electrodes of another electrical system.

3. Separately derived electrical system grounding electrode

a. Ground each separately derived system per CEC/NEC 250-26 or as shown on Drawings, whichever is greater.

4. Metal underground water pipe

a. Contractor shall install am accessible grounding electrode conductor from the main incoming cold water line to BGB. The electrode conductor shall be sized per CEC/NEC Table 250-94 or as shown on Drawings, whichever is greater.

B. Grounding electrode conductor

1. Provide grounding electrode conductors per CEC/NEC Table 250-94 or as shown on Drawings, whichever is greater.

C. Power system grounding

1. Connect the following items using code size copper grounding conductors to BGB or as shown on Drawings:

a. Concrete encased electrode (Ufer ground)

b. Ground rod(s)

c. Incoming cold and fire water pipes

d. Gas pipe

e. Structural steel

f. Distribution transformer secondary

D. Equipment Bonding/Grounding

1. Provide a code sized copper ground conductor, whether indicated or noted on the drawings, in each of the following:

   a. All power distribution conduits and ducts

   b. Distribution feeders

   c. Motor and equipment branch circuits\

   d. Device branch circuits

2. Provide a separate grounding bus at distribution panelboards, loadcenters, switchboards and motor control centers. Connect all metallic enclosed equipment so that with maximum fault current flowing, shall be maintained at not more than 35V above ground.

3. Metallic conduits terminating in concentric, eccentric or oversized knockouts at panelboards, cabinets, gutters, etc. shall have grounding bushings and bonding jumpers installed interconnecting all such conduits.

4. Provide bonding jumpers across expansion and deflection coupling in conduit runs, pipe connections to water meters and metallic cold water dielectric couplings.

5. Provide ground wire in flexible conduit connected at each end via grounding bushing.

6. Provide bonding jumpers across all cable tray joints.

7. Bond each end of metallic conduit longer than 36” in length to grounding conductor using a #6 AWG pigtail.

3.02 FIELD QUALITY CONTROL

A. Contractor using test equipment expressly designed for that purpose shall perform all ground resistance tests in conformance with IEEE quidelines. Contractor shall submit typewritten records of measured resistance values to Engineer for review and approval prior to energizing the system.

B. Obtain and record ground resistance measurements both from electrical equipment ground bus to the ground electrode and from the ground electrode to earth. Furnish and install additional bonding and add grounding electrodes as required to comply with the following resistance limits:

1. Resistance from ground bus to ground electrode and to earth shall not exceed 5 ohms unless otherwise noted.

2. Resistance from the farthest panelboard, loadcenter, switchboard or motor control center ground bus to the ground electrode and to earth shall not exceed 20 ohms maximum.

C. Inspection

1. The Engineer or Inspector prior to encasement, burial or concealment thereto shall review the grounding electrode and connections.

END OF SECTION

SECTION 26 05 33 – RACEWAYS AND BOXES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes

1. Provide all labor, materials and equipment necessary to complete the installation required for the items specified under this Section, including but not limited to electrical conduits; outlet, junction and pull boxes; and related supports.

B. Related sections

1. Where items specified in other Division 26 sections conflict with the requirements of this Section, the most stringent requirement shall govern.
    a. 26 05 26 – Grounding and Bonding for Electrical Systems
2. The requirements of this Section apply to all Division 26 work, as applicable.
3. Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified:

1. ANSI –American National Standards Institute
    a. C33.91; Specification for Rigid PVC Conduit
    b. C80.1; Specification Rigid Steel Conduit, Zinc-Coated
    c. C80.3; Specification for Electrical Metallic Tubing, Zinc-Coated
    d. C80.6; Intermediate Metal Conduit (IMC), Zinc-Coated
2. CCR –California Code of Regulations, Title 24
    a. Part 2 -California Building Code (CBC); International Building Code (IBC) with California amendments
    b. Part 3 -California Electrical Code(CEC); NFPA 70 National Electrical Code (NEC) with California amendments
3. NECA –National Electrical Contractors Association
    a. 101, Standard for Installing Steel Conduit (Rigid, IMC, EMT)
    b. 111, Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC) (ANSI)
4. NEMA –National Electrical Manufacturer’s Association
    a. FB 1; Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable

b. FB 2.10; Selection and Installation Guidelines for Fittings for Use with Non-flexible Electrical Metal Conduit or Tubing (Rigid Metal Conduit, Intermediate Metal Conduit, and Electrical Metallic Tubing)

c. FB 2.20; Selection and Installation Guidelines for Fittings for Use with Flexible Electrical Conduit and Cable

d. OS 1; Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports

e. OS 3; Selection and Installation Guidelines for Electrical Outlet Boxes

f. RN 1; Polyvinyl-Chloride Externally Coated Galvanized Rigid Steel Conduit and Electrical Metallic Tubing

g. TC 2; Electrical Plastic Tubing and Conduit

h. TC 3; PVC Fittings for Use with Rigid PVC Conduit and Tubing

i. TC 14; Reinforced Thermosetting Resin Conduit (RTRC) and Fittings

5. OSHPD Anchorage Pre-approvals

a. OPA-0003; Superstrut Seismic Restraint System

b. OPA-0114; B-Line Seismic Restraints

c. OPA-0120; Unistrut Seismic Bracing System

d. OPA-0242; Power-Strut Seismic Bracing System

6. UL –Underwriter's Laboratories, Inc.

a. 1; Standard for Flexible Metal Conduit

b. 6; Rigid Metal Electrical Conduit

c. 360; Standard for Liquid-Tight Flexible Steel Conduit

d. 514A; Metallic Outlet Boxes, Electrical

e. 514B; Fittings for Conduit and Outlet Boxes

f. 651; Schedule 40 & 80 PVC Conduit

g. 797; Electrical Metallic Tubing

h. 1242; Intermediate Metal Conduit

i. 1684; Reinforced Thermosetting Resin Conduit (RTRC) and Fittings

1.03 SYSTEM DESCRIPTION

A. Furnish, assemble, erect, install, connect and test all electrical conduits and related raceway apparatus required and specified to form a complete installation.

1.04 SUBMITTALS

A. Submit manufacturer's data for materials specified within this Section in accordance to Section 26 05 00.

1.05 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the materials specified herein shall be new and unused, bearing UL labels where applicable.

B. Installation shall conform to the NECA installation guidelines unless otherwise indicated within this Section

PART 2 - PRODUCTS

2.01 MATERIALS

A. Conduits and Fittings

1. Rigid steel conduit (RMC)

a. Conduit: Standard weight, mild steel pipe, and zinc coated on both inside and outside by a hot dipping or shearardizing process manufactured in accordance with UL 6 and ANSI C80.1 specifications.

b. Fittings (couplings, elbows, bends, etc.)

1) Shall be steel or malleable iron.

2) Coupling and unions shall be threaded type, assembled with anti-corrosion, conductive and anti-seize compound at joints made absolutely tight to exclude water.

c. Bushings

1) Insulating bushings: Threaded polypropylene or thermosetting phenolic rated at 150°C minimum.

2) Insulating grounding bushing: Threaded cast body with insulating throat and steel “lay-in” ground lug.

3) Insulating metallic bushing: Threaded cast body with plastic insulated throat rated at 150°C minimum.

2. Coated rigid steel conduit (CRMC)

a. Conduit: Equivalent to RMC with a Polyvinyl chloride (PVC) coated bonded to the galvanized outer surface of the conduit. The bonding between the PVC coating and conduit surface shall be ETL PVC-001 compliant. The coating thickness shall be a minimum of 40mil.

b. Fittings (couplings, elbows, bends, etc.)

1) Equivalent to RMC above with bonded coating same as conduit.

2) The PVC sleeve over fittings shall extend beyond hub or coupling approximately one diameter or 1 1/2” whichever is smaller.

c. Bushing equivalent to RMC above.

3. Intermediate metallic conduit(IMC)
    a. Conduit: Intermediate weight, mild steel pipe, meeting the same requirements for finish and material as rigid steel conduit manufactured in accordance with UL 1242 and ANSI C80.6 specifications
    b. Fittings (couplings, elbows, bends, etc.) equivalent to RMC above.
    c. Bushing equivalent to RMC above.
4. Electrical metallic tubing (EMT)
    a. Conduit: Cold rolled steel tubing with zinc coating on outside and protective enamel on inside manufactured in accordance with UL 797 and ANSI C80.3 specifications.
    b. Couplings: Steel or malleable iron with compression type fastener via a nut.
    c. Connectors: Steel or malleable iron with compression type fastener via a nut with plastic insulated throat rated at 150°C minimum.
5. Rigid non-metallic conduit (PVC)
    a. Conduit: PVC composed Schedule 40, 90°C manufactured in accordance with NEMA TC 2 and UL 651 specifications.
    b. Fittings: Molded PVC, slip on solvent welded type in accordance to NEMA TC 3.
6. Reinforced thermosetting resin conduit (RTRC)
    a. Conduit: Fiber impregnated with a cured thermosetting resin compound in accordance with NEMA TC 14 and UL1684.
    b. Fittings: Molded resin with glass reinforcement manufactured in the same process as the conduit bonded with an epoxy adhesive.
7. Flexible metallic conduit (FMC)
    a. Conduit: Continuous, flexible steel spirally wound with zinc coating on both inside and outside in accordance with UL 1.
    b. Connectors: Steel or malleable iron with compression type fastener via a nut with plastic insulated throat rated at 150°C minimum.
8. Liquidtight flexible metallic conduit (LFMC)
    a. Conduit: PVC coated, continuous, flexible steel spirally wound with zinc coating on both inside and outside in accordance with UL 360.
    b. Connectors: Steel or malleable iron with compression type fastener via a nut with plastic insulated throat rated at 150°C minimum.
9. Miscellaneous Fittings and Products
    a. Conduit sealing bushings: Steel or cast malleable iron body and pressure clamps with PVC sleeve, neoprene sealing grommets and PVC coated steel pressure rings. Supplied with neoprene sealing rings between body and PVC sleeve.

b. Watertight cable terminators: One piece, compression molded sealing ring with PVC coated steel pressure disks, stainless steel screws and zinc plated cast iron locking collar.

c. Watertight cable/cord connectors: Liquidtight steel or cast malleable iron body with sealing neoprene bushing and stainless steel retaining ring.

d. Expansion fittings: Multi-piece unit of hot dip galvanized malleable iron or steel body and outside pressure bussing design to allow a maximum of 4" movement (2" in either direction). Furnish with external braid tinned copper bonding jumper. UL listed for both wet and dry locations.

e. Expansion/deflection couplings: Multi-piece unit comprised of a neoprene sleeve, internal flexible tinned copper braid attached to bronze end couplings with stainless steel bands. Coupling to provide minimum of 3/4" movement and 30 degrees deflection from normal. UL listed for both wet and dry locations.

f. Conduit bodies: Raintight, malleable iron, hot-dip galvanized body with threaded hubs, stamped steel cover, stainless steel screws and neoprene gasket.

g. Other couplings, connectors and fittings shall be equal in quality, material and construction to items specified herein.

B. Boxes

1. Outlet boxes

a. Standard: Galvanized one-piece of welded pressed steel type in accordance with NEMA OS 1 and UL 514. Boxes shall not be less than 4" square and at least 1 1/2" deep.

b. Concrete: Galvanized steel, 4" octagon ring with mounting lug, backplate and adapter ring type in accordance with NEMA OS 1 and UL 514. Depth as required by application.

c. Masonry: Galvanized steel, 3.75" high gang box in accordance with NEMA OS 1 and UL 514.

d. Surface cast metal: Cast malleable iron body, surface mounted box with threaded hubs and mounting lugs as required in accordance with NEMA OS 1 and UL 514. Furnish with ground flange, steel cover and neoprene gasket.

2. Pull and junction boxes

a. Sheet metal boxes: Standard or concrete outlet box wherever possible; otherwise use 16 gauge galvanized sheet metal, NEMA 1 box sized per CEC with machine screwed cover.

b. Cast metal boxes: Install standard cast malleable iron outlet or device box when possible.

c. Flush mounted boxes: Install overlapping cover with flush head screws.

d. In-ground mounted pull holes/boxes: Install pre-cast concrete box, sized per Drawing or CEC with pre-cast or traffic rated lid.

3. Floor boxes

   a. Floor boxes shall be adjustable, cast metal body with threaded conduit openings, adjustable rings, brass flange or Lexan ring and cover plate with threaded plug. Include provisions to accommodate surface mounted telephone or receptacle outlet, or flush floor mounted telephone or receptacle outlet where shown on Drawings.

C. Pull line/cord

1. Polypropylene braided line or Let-line #232 or equal of 1/8” diameter with a minimum break strength of 200 pounds.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Thoroughly examine site conditions for acceptance of wire and cable installation to verify conformance with manufacturer and specification tolerances. Do not commence with work until all conditions are made satisfactory.

3.02 PREPARATION

A. Conduit

1. Provide all necessary conduit fittings, connectors, bushings, etc. required to complete conduit installation to meet the CEC/NEC and intended application whether noted, shown or specified within.
2. Location of conduit runs shall be planned in advance of the installation and coordinated with other trades.
3. Where practical, install conduits in groups in parallel vertical or horizontal runs that avoid unnecessary offsets.
4. All conduits shall be parallel or at right angles to columns, beams and walls whether exposed or concealed.
5. Conduits shall not be placed closer than 12” to a flue, parallel to hot water, steam line or other heat sources; or 3” when crossing perpendicular to the above said lines when possible.
6. Install exposed conduit as high as practical to maintain adequate headroom. Notify Engineer if headroom will be less than 102”.
7. Do not obstruct spaces required by Code in front of electrical equipment, access doors, etc.
8. The largest trade size conduit in concrete floors and walls shall not exceed 1/3 thickness or be spaced a less than three conduit diameters apart unless permitted by Engineer. All conduits shall be installed in the center of slab or wall, and never between reinforcing steel and bottom of floor slab.

9. Install additional pull boxes, not shown on Drawings, in sufficient quantities to facilitate pulling of conductors and cables such that total spacing does not exceed 150 feet or 270 degrees, total; and maximum pulling tension will not be exceeded.
10. When installing underground conduits to specified depth; depth shall be taken from finished grade as it will be at project completion. Should finish grade be above existing grade by an amount equal to or greater than specified depth, conduit shall be installed not less than 6” below existing grade.
11. Verify that information concerning finish grade is accurate, for should the underground run be less than the specified depth, Contractor may be required to re-install conduit to meet the required depth.
12. Unless otherwise specified, underground conduits shall be installed with top side not less than 24” below finished grade; this depth applies to all conduits outside of building foundations including those under walks, open corridors or paved areas.
13. Utility company service conduits installation depth shall be as directed by their respective specifications and requirements.

B. Boxes

1. Before locating outlet boxes, check Construction Documents for type of construction and make sure that there is no conflict with other equipment. Locate outlet boxes as shown and locate so as not to interfere with other Work or equipment.
2. Install all outlet boxes flush within walls, ceiling and floors except where installed within non-finished rooms, cabinetry, attic spaces or as indicated on Drawings.
3. Locate pull boxes and junction boxes within concealed, accessible locations where possible.
4. Do not install outlet boxes back-to-back with same stud space. Where shown back-to-back, offset as required, and fill void with sound dampening material where requested by Owner.
5. In fire rated walls separate boxes by 24” minimum and with stud member.
6. Adjust position of outlet boxes within masonry wall to accommodate course lines.

3.03 INSTALLATION

A. Conduit

1. Minimum conduit size shall be 3/4” unless otherwise indicated.
2. All conduit work shall be concealed unless otherwise indicated. Exposed conduits shall be permitted within unfinished rooms/spaces to facilitate installation.
3. Install conduit in complete runs prior to installing conductors or cables.
4. Make long radius conduits bends free from kink, indentations or flattened surfaces. Make bends carefully to avoid injury or flattening. Bends 1 1/4” size and larger shall be factory made ells, or be made with a manufactured

mechanical bender. Heating of steel conduit to facilitate bending or that damage galvanized coating will not be permitted.

5. Remove burrs and sharp edges at end of conduit with tapered reamer.
6. Protect and cover conduits during construction with metallic bushings and bushing “pennies” to seal exposed openings.
7. Assemble conduit threads with anti-corrosion, conductive, anti-seize compound and tighten securely.
8. Install conduits shall that no traps to collect condensation exist.
9. Fasten conduit securely to boxes with locknuts and bushings to provide good grounding continuity.
10. Install pull cords/line within any spare or unused conduits of sufficient length to facilitate future cable installation.
11. Penetrations
    a. Locate penetrations within structural members as shown on Drawings and as directed by Architect or Engineer. Should it be necessary to notch any framing member, make such notching only at locations and in a manner as approved by Engineer.
    b. Do not chase concrete or masonry to install conduit unless specifically approved by Engineer.
    c. Cutting or holes
        1) Install sleeves for cast-in-place concrete floors and walls. After installing conduit through penetration, seal using dry-pack grouting compound (non-iron bearing, chloride free and non-shrinking) or fire rated assembly if rated floor or wall. Use escutcheon plate on floor underside to contain compound as necessary.
        2) Cut holes with a hole saw for penetrations through non-concrete or non-masonry members.
        3) Provide chrome plated escutcheon plates at all publicly exposed wall, ceiling and floor penetrations.
    d. Sealing
        1) Non-rated penetration openings shall be packed with non-flammable insulating material and sealed with gypsum wallboard taping compound.
        2) Fire rated penetration shall be sealed using a UL classified fire stop assembly suitable to maintain the equivalent fire rating prior to the penetration.
        3) Use escutcheon plates to hold sealing or fire rated compound as necessary.
    e. Waterproofing
        1) Make penetrations through any damp-proofed/waterproofed surfaces within damp/wet locations as such as to maintain integrity of surface.

2) Install specified watertight conduit entrance seals at all below grade wall and floor penetrations.

3) At roof penetrations furnish roof flashing, counter flashing and pitch-pockets compatible to roof assembly.

4) Where possible conduits that horizontally penetrate a waterproof membrane shall fall away from and below the penetration's exterior side.

5) Make penetrations through floors watertight with mastic, even when concealed within walls or furred spaces.

12. Supports

a. Conduits shall be support and braced per OSHPD pre-approved anchorage systems when those methods are implemented and installed.

b. Sizes of rods and cross channels shall be capable of supporting 4 times and 5 times actual load, respectively. Anchorage shall support the combined weight of conduit, hanger and conductors.

c. Support individual horizontal conduit 1 1/2" and smaller by means of 2 hole straps or individual hangers.

d. Galvanized iron hanger rods sizes 1/4" diameter and larger with spring steel fasteners, clips or clamps specifically design for that purpose for 1 1/2" conduits and larger.

e. Support multi-parallel horizontal conduits runs with trapeze type hangers consisting of 2 or more steel hanger rods, preformed cross channels, 'J' bolts, clamps, etc.

f. Support conduit to wood structures by means of bolts or lag screws in shear, to concrete by means of insert or expansion bolts and to brickwork by means of expansion bolts.

g. Support multi-parallel vertical conduits runs with galvanized Unistrut, Power-Strut or approved equal type supports anchored to wall. Where multi-floored conduits pass through floors, install riser clamps at each floor.

h. Maximum conduit support spacing shall be in accordance with NECA Standard of Installation:

1) Horizontal runs:

a) 3/4" and smaller at 60" on centers, unless building construction prohibits otherwise, then 84" on centers.

b) 1" and larger at 72" on centers, unless building construction prohibits otherwise or any other condition, then 120" on centers.

2) Vertical runs:

a) 3/4" and smaller @ 84" on centers.

b) 1" and 1 1/4" @ 96" on centers.

c) 1 1/2" and larger @ 120" on centers.

d) Any vertical condition such as shaftways and concealed locations for any sized conduit, 120" on centers.

i. Anchorage for RMC/IMC supports unless otherwise specified:

1) < 1” IMC/RMC = #10 bolt/screw.

2) 1” IMC/RMC = 1/4” bolt/screw.

3) 1 1/2” and 2” IMC/RMC = 3/8” bolt/screw.

4) 3” IMC/RMC, 4” EMT = 1/2” bolt/screw.

5) > 3” IMC/RMC = 5/8” bolt/screw.

j. Anchorage for EMT supports unless otherwise specified:

1) < 1 1/2” EMT = #10 bolt/screw.

2) 1 1/2” EMT = 1/4” bolt/screw.

3) 2, 2 1/2” and 3” EMT = 3/8” bolt/screw.

4) 4” EMT = 1/2” bolt/screw.

5) > 4” EMT = 5/8” bolt/screw.

B. Boxes

1. Install boxes as shown on Drawings and as required for splices, taps, wire pulling, equipment connections and Code compliance.
2. Install additional pull boxes, not shown on Drawings, in sufficient quantities to facilitate pulling of conductors and cables such that total spacing does not exceed 150 feet or 270 degrees, total; and maximum pulling tension will not be exceeded.
3. Install plaster rings on all outlet boxes in stud walls or in furred, suspended or exposed ceilings. Covers shall be of a depth suited for installation.
4. Provide gasketed cast metal cover plates where boxes are exposed in damp or wet locations
5. Install access door for boxes installed within concealed locations without access.
6. Install approved factory made knockout seal where knockouts are not present.
7. Refer to Architectural interior elevations and details shown for exact mounting heights of all electrical outlets. In general, locate outlets as shown or specific and complies with Americans with Disabilities Act:
   a. Convenience outlets: +18”AFF or +6” above counter or splash.
   b. Local switches: +48”AFF or +6” above counter or splash.
   c. Telecommunication outlets: +18”AFF or +48”AFF for wall telephone or intercom device.
   d. Verify all mounting heights with Architectural Drawings, and where heights are not suited for construction or finish please consult Engineer or Architect.
8. Use conduit bodies to facilitate pulling of conductor or cables or change conduit direction. Do not splice within conduit bodies.
9. Enclose pull box with additional rated gypsum board as necessary to maintain wall’s original fire rating.

10. Install galvanized steel coverplates on all open boxes within dry listed areas.
11. Install in-ground pull holes/boxes flush to grade finish at finished areas or 1" above finished landscaped grade. Seal all conduits terminating in pull hole/box watertight. Install and grout around bell ends where shown. Cover and lids shall be removable without damage to adjacent finish surfaces.
12. Support
    a. Accurately place boxes for finish, independently and securely supported by adequate blocking or manufacturer channel type heavy-duty box hangers for stud walls. Do not use nails to support boxes.
    b. Support boxes independent of conduit system.
    c. Mount boxes installed within ceilings to 16 gauge metal channel bars attached to main runners or joists.
    d. Support boxes within suspended acoustical tile ceilings directly from structure above when light fixture are to be installed from box.
    e. Use auxiliary plates, bar or clips and grouted in place for masonry, block or pour-in-place concrete construction.

3.04 APPLICATION

A. Conduit
   1. RMC/IMC suitable for all damp, dry and wet locations except when in contact with earth. IMC not suitable for hazardous locations as stated within CEC/NEC.
   2. CRMC suitable for damp or wet locations, concealed within concrete or in contact with earth.
   3. EMT suitable for exposed or concealed dry, interior locations.
   4. PVC/RTRC suitable for beneath ground floor slab, except when penetrating, and direct earth burial. Do not run exposed within concrete walls or in floor slab unless indicated on Drawings or per Engineer's permission.
   5. FMC suitable for dry locations only for connections to motors, transformers, vibrating equipment/machinery, controllers, valves, switches and light fixtures in less than 6 foot lengths.
   6. LFMC application same as FMC above but for damp or wet locations.

B. Termination and joints
   1. Use raceway fittings compatible with associated raceway and suitable for the location.
   2. Raceways shall be joined using specified couplings or transitions where dissimilar raceway systems are joined.
   3. Conduits shall be securely fastened to cabinets, boxes and gutters using (2) two locknuts and insulating bushing or specified insulated connector. Where joints cannot be made tight and terminations are subject to vibration, use bonding jumpers, bonding bushings or wedges to provide electrical continuity of the raceway system. Use insulating bushings to protect conductors where subjected

to vibration or dampness. Install grounding bushings or bonding jumpers on all conduits terminating at concentric or eccentric knockouts.

4. Terminations exposed at weatherproof enclosures and cast outlet boxes shall be made watertight using specified connectors and hubs.
5. Stub freestanding equipment conduits through concrete floors for connections with top of coupling set flush with finished floor. Install plugs to protect threads and entrance of debris.
6. Install specified cable sealing bushings on all conduits originating outside the building walls and terminating within interior switchboard, panel, cabinet or gutters. Install cable sealing bushings or raceway seal for conduit terminations in all grade level or below grade exterior pull, junction or outlet boxes.
7. Where conduits enter building from below grade inject into filled raceways pre-formulated rigid 2 lbs. density polyurethane foam suitable for sealing against water, moisture, insects and rodents.
8. Install expansion fitting or expansion/deflection couplings per manufacturer's recommendations where:
    a. Any conduit that crosses a building structure expansion joint; secure conduit on both sides to building structure and install expansion fitting at joint.
    b. Any conduit that crosses a concrete expansion joint; install expansion/deflection at joint.
    c. Any conduit greater than 1-1/4" is routed along roof top in runs greater than 100 feet; install expansion fittings every 100 feet.
    d. Engineer may allow FMC or LFMC in lieu of expansion fitting or expansion/deflection couplings on conduits 2" and smaller within accessible locations upon further review and written consent.

C. Boxes

1. Standard type suitable for all flush installations and all dry concealed locations.
2. Concrete type suitable for all flush concrete installations.
3. Masonry type suitable for all flush concrete and block installations.
4. Surface cast metal type suitable for all exposed damp and wet surface mounted locations, and dry surface mounted locations less than 96" from finished floor

END OF SECTION

SECTION 26 09 36 -- MODULAR DIMMING CONTROLS – LUTRON

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Standalone lighting control systems and associated components:
   1. Fluorescent electronic dimming ballasts.
   2. LED drivers.
   3. Power interfaces.
   4. Main units.
   5. Lighting control modules.
   6. Digital dimming ballast and switching modules.
   7. Control stations.
   8. Low-voltage control interfaces.
   9. Wired sensors.
   10. Wireless sensors.
   11. Accessories.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. 47 CFR 15 – Radio Frequency Devices*; current edition*.
B. ANSI C82.11 - American National Standard for Lamp Ballasts - High Frequency Fluorescent Lamp Ballasts - Supplements*; 2011*.
C. ANSI/ESD S20.20 - Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices)*; 2014*.
D. ASTM D4674 - Standard Practice for Accelerated Testing for Color Stability of Plastics Exposed to Indoor Office Environments*; 2002a (Reapproved 2010)*.
E. CAL TITLE 24 P6 – California Code of Regulations, Title 24, Part 6 (California Energy Code)*; 2013*.
F. CSA C22.2 No. 223 – Power Supplies with Extra-low-voltage Class 2 Outputs; 2015.
G. IEC 60929 - AC and/or DC-Supplied Electronic Control Gear for Tubular Fluorescent Lamps - Performance Requirements*; 2015*.
H. IEC 61000-4-2 - Electromagnetic Compatibility (EMC) - Part 4-2: Testing and Measurement Techniques - Electrostatic Discharge Immunity Test*; 2008*.
I. IEC 61000-4-5 - Electromagnetic Compatibility (EMC) - Part 4-5: Testing and Measurement Techniques - Surge Immunity Test*; 2014*.
J. IEC 61347-2-3 - Lamp Control Gear - Part 2-3: Particular Requirements for A.C. and/or D.C. Supplied Electronic Control Gear for Fluorescent Lamps*; 2011*.
K. IEEE 1789 - Recommended Practice for Modulating Current in High-Brightness LEDs for Mitigating Health Risks to Viewers*; 2015*.
L. IEEE C62.41.2 - Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits*; 2002 (Cor 1, 2012)*.
M. ISO 9001 - Quality Management Systems-Requirements*; 2008*.
N. NECA 1 - Standard for Good Workmanship in Electrical Construction*; 2010*.
O. NECA 130 - Standard for Installing and Maintaining Wiring Devices; National Electrical Contractors Association*; 2010*.
P. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; National Electrical Manufacturers Association*; 2011*.
Q. NEMA WD 1 - General Color Requirements for Wiring Devices; National Electrical Manufacturers Association*; 1999 (R 2010)*.

R. NFPA 70 - National Electrical Code; National Fire Protection Association*; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements*.
S. UL 94 - Tests for Flammability of Plastic Materials for Parts in Devices and Appliances*; Current Edition, Including All Revisions*.
T. UL 508 - Industrial Control Equipment; Underwriters Laboratories Inc.*; Current Edition, Including All Revisions*.
U. UL 924 - Emergency Lighting and Power Equipment*; Current Edition, Including All Revisions*.
V. UL 935 - Fluorescent-Lamp Ballasts*; Current Edition, Including All Revisions*.
W. UL 1310 – Class 2 Power Units; Current Edition, Including All Revisions.
X. UL 1472 - Solid-State Dimming Controls*; Current Edition, Including All Revisions*.
Y. UL 1598C - Light-Emitting Diode (LED) Retrofit Luminaire Conversion Kits; Current Edition, Including All Revisions.
Z. 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*.
AA. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products*; Current Edition, Including All Revisions*.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Coordinate the placement of sensors and wall controls with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate the placement of wall controls with actual installed door swings.
3. Coordinate the placement of daylight sensors with windows, skylights, and luminaires to achieve optimum operation. Coordinate placement with ductwork, piping, equipment, or other potential obstructions to light level measurement installed under other sections or by others.
4. Where motorized window treatments are to be controlled by the lighting control system provided under this section, coordinate the work with other trades to provide compatible products.
5. Coordinate the work to provide luminaires and lamps compatible with the lighting controls to be installed.
6. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

B. Preinstallation Meeting: Conduct on-site meeting with lighting control system manufacturer prior to commencing work as part of manufacturer's standard startup services. Manufacturer to review with installer:
1. Low voltage wiring requirements.
2. Separation of power and low voltage/data wiring.
3. Wire labeling.
4. Where Lighting Control Manufacturer Sensor Layout and Tuning service is specified in Part 2 under "LIGHTING CONTROL SYSTEM - GENERAL REQUIREMENTS", sensor locations to be reviewed in accordance with layout provided by Lighting Control Manufacturer. Lighting Control Manufacturer may direct Contractor regarding sensor relocation should conditions require a deviation from locations indicated.
5. Control locations.
6. Load circuit wiring.
7. Connections to other equipment.
8. Installer responsibilities.

C. Sequencing:
   1. Do not install sensors and wall controls until final surface finishes are complete.

1.05 SUBMITTALS

A. See Section *01 3000 - Administrative Requirements* for submittal procedures.
B. Design Documents: Where Lighting Control Manufacturer Sensor Layout and Tuning service is specified in Part 2 under "LIGHTING CONTROL SYSTEM - GENERAL REQUIREMENTS", Lighting Control Manufacturer to provide plans indicating occupancy/vacancy and/or daylight sensor locations.
C. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
   1. Occupancy/Vacancy Sensors: Include detailed basic motion detection coverage range diagrams.
D. Shop Drawings:
   1. Provide schematic system riser diagram indicating component interconnections. Include requirements for interface with other systems.
E. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
F. Title 24 Acceptance Testing Documentation: Submit Certification of Acceptance and associated documentation for lighting control acceptance testing performed in accordance with CAL TITLE 24 P6, as specified in Part 3 under “COMMISSIONING”.
G. Project Record Documents: Record actual installed locations and settings for lighting control system components.
H. Operation and Maintenance Data: Include detailed information on lighting control system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.
I. Warranty: Submit sample of manufacturer's Warranty or Enhanced Warranty as specified in Part 1 under "WARRANTY". Submit documentation of final execution completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.
B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
C. Manufacturer Qualifications:
   1. Company with not less than ten years of experience manufacturing lighting control systems of similar complexity to specified system.
   2. Registered to ISO 9001, including in-house engineering for product design activities.
   3. Qualified to supply specified products and to honor claims against product presented in accordance with warranty.
D. Title 24 Acceptance Testing Technician Qualifications: Certified by a California approved Acceptance Test Technician Certification Provider as an Acceptance Test Technician (ATT) in accordance with CAL TITLE 24 P6.
E. Maintenance Contractor Qualifications: Manufacturer's authorized service representative.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.08 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1. System Requirements - *Lutron*, Unless Otherwise Indicated:

a. Ambient Temperature:

1) Lighting Control System Components, Except Those Listed Below: Between 32 and 104 degrees F (0 and 40 degrees C).

2) Fluorescent Electronic Dimming Ballasts: Between 50 and 140 degrees F (10 and 60 degrees C).

b. Relative Humidity: Less than 90 percent, non-condensing.

1.09 WARRANTY

A. See Section *01 7800 - Closeout Submittals*, for additional warranty requirements.

B. Include additional costs for manufacturer's Enhanced Warranty with manufacturer Start-up*; Silver Enhanced Warranty; Lutron LSC-E8S*; coverage to include items listed under manufacturer's standard warranty with manufacturer start-up above, plus the following upgrades:

1. Manufacturer Lighting Control System Components, Except Ballasts/Drivers and Ballast Modules:

a. First Two Years:

1) As-available Field Service response; no committed response time.

b. Additional Coverage for Years 3-5: 50 percent replacement parts coverage, no manufacturer labor coverage.

c. Additional Coverage for Years 6-8: 25 percent replacement parts coverage, no manufacturer labor coverage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Manufacturer: *Lutron Electronics Company, Inc;* www.lutron.com or approved equal.

2.02 LIGHTING CONTROL SYSTEM - GENERAL REQUIREMENTS

A. Sensor Layout and Tuning: Include additional costs for Lighting Control Manufacturer's Sensor Layout and Tuning service*; Lutron LSC-SENS-LT*:

1. Lighting Control Manufacturer to take full responsibility for wired or wireless sensor layout and performance for sensors provided by Lighting Control Manufacturer.

2. Lighting Control Manufacturer to analyze the reflected ceiling plans, via supplied electronic AutoCAD format, and design a detailed sensor layout that provides adequate occupancy sensor coverage and ensures occupancy and daylight sensor performance per agreed upon sequence of operations. Contractor to utilize the layouts for sensor placement.

3. During startup, Lighting Control Manufacturer to direct Contractor regarding sensor relocation, as required, should conditions require a deviation from locations specified in the drawings..

4. Lighting Control Manufacturer to provide up to two additional post-startup on-site service visits within one calendar year from Date of Substantial Completion to fine-tune sensor calibration per the agreed upon sequence of operations.

B. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) as suitable for the purpose indicated.

C. 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 that provides the control intent indicated.

D. Shade Control Requirements:
   1. Capable of operating shades and recalling shade presets via keypad, contact closure input, infrared receiver, lighting management system software, or other lighting control system interface.
   2. Capable of operating any individual, group, or subgroup of shade electronic drive units within system without requiring separate group controllers.
   3. Capable of assigning and reassigning individual, groups, and subgroups of shades to any control within system without requiring additional wiring or hardware changes.
   4. Capable of controlling shade speed for tracking within plus or minus 0.125 inch (3.17 mm) throughout entire travel.
   5. Provide 10 year power failure memory for preset stops, open and close limits, shade grouping and sub grouping and system configuration.
   6. Capable of synchronizing multiple shade electronic drive units of the same size to start, stop and move in unison.
   7. Capable of stopping shades within accuracy of 0.125 inch (3.17 mm) at any point between open and close limits.
   8. Capable of storing up to 250 programmable stop points, including open, close, and any other position.

E. Design lighting control equipment for 10 year operational life while operating continually at any temperature in an ambient temperature range of 32 degrees F (0 degrees C) to 104 degrees F (40 degrees C) and 90 percent non-condensing relative humidity.

F. Electrostatic Discharge Tolerance: Design and test equipment to withstand electrostatic discharges without impairment when tested according to IEC 61000-4-2.

G. Dimming and Switching (Relay) Equipment:
   1. Designed so that electrolytic capacitors operate at least 36 degrees F (2 degrees C) below the capacitor's maximum temperature rating when the device is under fully loaded conditions at maximum rated temperature.
   2. Inrush Tolerance:
      a. Utilize load-handling thyristors (SCRs and triacs), field effect transistors (FETs) and isolated gate bipolar transistors (IGBTs) with maximum current rating at least two times the rated operating current of the dimmer/relay.
      b. Capable of withstanding repetitive inrush current of 50 times the operating current without impacting lifetime of the dimmer/relay.
   3. Surge Tolerance:
      a. Panels: Designed and tested to withstand surges of 6,000 V, 3,000 amps according to IEEE C62.41.2 and IEC 61000-4-5 without impairment to performance.
      b. Other Power Handling Devices: Designed and tested to withstand surges of 6,000 V, 200 amps according to IEEE C62.41.2 without impairment to performance.
   4. Power Failure Recovery: When power is interrupted and subsequently restored, within 3 seconds lights to automatically return to same levels (dimmed setting, full on, or full off) as prior to power interruption.

5. Dimming Requirements:
   a. Line Noise Tolerance: Provide real-time cycle-by-cycle compensation for incoming line voltage variations including changes in RMS voltage (plus or minus 2 percent change in RMS voltage per cycle), frequency shifts (plus or minus 2 Hz change in frequency per second), dynamic harmonics, and line noise.
      1) Systems not providing integral cycle-by-cycle compensation to include external power conditioning equipment as part of dimming system.
   b. Incorporate electronic "soft-start" default at initial turn-on that smoothly ramps lights up to the appropriate levels within 0.5 seconds.
   c. Utilize air gap off to disconnect the load from line supply.
   d. Control all light sources in smooth and continuous manner. Dimmers with visible steps are not acceptable.
   e. Load Types:
      1) Assign a load type to each dimmer that will provide a proper dimming curve for the specific light source to be controlled.
      2) Provide capability of being field-configured to have load types assigned per circuit.
   f. Minimum and Maximum Light Levels: User adjustable on a circuit-by-circuit basis.
   g. Line Voltage Dimmers:
      1) Dimmers for Magnetic Low Voltage (MLV) Transformers:
         (a) Provide circuitry designed to control and provide a symmetrical AC waveform to input of magnetic low voltage transformers per UL 1472.
         (b) Dimmers using unipolar load current devices (such as FETs or SCRs) to include DC current protection in the event of a single device failure.
      2) Dimmers for Electronic Low Voltage (ELV) Transformers: Operate transformers via reverse phase control. Alternately, forward phase control dimming may be used if dimming equipment manufacturer has recommended specific ELV transformers being provided.
      3) Dimmers for Neon and Cold Cathode Transformers:
         (a) Magnetic Transformers: Listed for use with normal (low) power factor magnetic transformers.
         (b) Electronic Transformers: Must be supported by the ballast equipment manufacturer for control of specific ballasts being provided.
   h. Low Voltage Dimming Modules:
      1) Coordination Between Low Voltage Dimming Module and Line Voltage Relay: Capable of being electronically linked to a single zone.
      2) Single low voltage dimming module; capable of controlling the following light sources:
         (a) 0-10V analog voltage signal.
            (1) Provide Class 2 isolated 0-10V output signal conforming to IEC 60929.
            (2) Sink current according to IEC 60929.
            (3) Source current.
         (b) 10-0 V reverse analog voltage signal.

(c) DSI digital communication.
(d) DALI broadcast communication per IEC 60929:
(1) Logarithmic intensity values complying with IEC 60929.
(2) Linear intensity values for use with LED color intensity control.
(e) PWM per IEC 60929.

6. Switching Requirements:
a. Rated Life of Relays: Typical of 1,000,000 cycles at fully rated 16 A for all lighting loads.
b. Switch load in a manner that prevents arcing at mechanical contacts when power is applied to and removed from load circuits.
c. Provide output fully rated for continuous duty for inductive, capacitive, and resistive loads.

H. Device Finishes:
1. Wall Controls: Match existing devices within space.
2. Standard Colors: Comply with NEMA WD1 where applicable.
3. Color Variation in Same Product Family: Maximum delta E of 1, CIE L*a*b color units.
4. Visible Parts: Exhibit ultraviolet color stability when tested with multiple actinic light sources as defined in ASTM D4674. Provide proof of testing upon request.

I. Provides one direct-wired occupancy sensor connection without interface or power pack.

2.03 LIGHTING CONTROL MODULES *(LUTRON ENERGI SAVR NODE)*

A. Provide lighting control modules as indicated or as required to control the loads as indicated.

B. General Requirements:
1. Listed to UL 508 as industrial control equipment.
2. Delivered and installed as a listed factory-assembled panel.
3. Passively cooled via free-convection, unaided by fans or other means.
4. Mounting: Surface.
5. Connection without interface to wired:
a. Occupancy sensors.
b. Daylight sensors.
c. IR receivers for personal control.
6. LED status indicators confirm communication with occupancy sensors, daylight sensors, and IR receivers.
7. Contact Closure Input:
a. Directly accept contact closure input from a dry contact closure or solid-state output without interface to:
1) Activate scenes.
(a) Scene activation from momentary or maintained closure.
2) Enable or disable after hours.
(a) Automatic sweep to user-specified level after user-specified time has elapsed.
(b) System will provide occupants a visual warning prior to sweeping lights to user-specified level.
(c) Occupant can reset timeout by interacting with the lighting system.

3) Activate or deactivate demand response (load shed).
(a) Load shed event will reduce lighting load by user-specified amount.

8. Emergency Contact Closure Input:
   a. Turn all zones to full output during emergency state via direct contact closure input from UL 924 listed emergency lighting interface, security system or fire alarm system.
   b. Allow configurable zone response during emergency state.
   c. Disable control operation until emergency signal is cleared.
9. Supplies power for control link for keypads and control interfaces.
10. Distributes sensor data among multiple lighting control modules.
11. Capable of being controlled via wireless sensors and controls.

C. Switching Lighting Control Modules:
   1. Switching:
      a. Rated Life of Relay: Typical of 1,000,000 cycles at fully rated 16 A for all lighting loads.
      b. Load switched in manner that prevents arcing at mechanical contacts when power is applied to and removed from load circuits.
      c. Fully rated output continuous duty for inductive, capacitive, and resistive loads.
      d. Module to integrate up to four individually controlled zones.
      e. Utilize air gap off, activated when user selects "off" at any control to disconnect the load from line supply.

D. 0-10V Lighting Control Modules:
   1. Product(s):
      a. Lutron 0-10 V Energi Savr Node; Model QSN-4T16-S: 16 A continuous-use per channel.
      b. Lutron 0-10 V Energi Savr Node; Model QSN-4T20-S: 20 A (16 A ballast) continuous-use per channel.
   2. Coordination Between Low Voltage Dimming Module and Line Voltage Relay: Capable of being electronically linked to single zone.
   3. Single low voltage dimming module; capable of controlling following light sources:
      a. 0-10 V analog voltage signal.
         1) Provide Class 2 isolated 0-10 V output signal conforming to IEC 60929.
         2) Sink current per IEC 60929.
      b. 10-0 V analog voltage signal.
         1) Provide Class 2 isolated 0-10 V output signal conforming to IEC 60929.
         2) Sink current per IEC 60929.
   4. Switching:
      a. Rated Life of Relay: Typical of 1,000,000 cycles at fully rated 16 A for all lighting loads.
      b. Load switched in manner that prevents arcing at mechanical contacts when power is applied to and removed from load circuits.
      c. Fully rated output continuous duty for inductive, capacitive, and resistive loads.
      d. Module to integrate up to four individually controlled zones.
      e. Utilize air gap off, activated when user selects "off" at any control to disconnect the load from line supply.

E. Digital Fixture Lighting Control Modules:
   1. Provides two-way feedback with digital fixtures for energy monitoring, light level status, lamp failure reporting, and ballast/driver failure reporting.
   2. Provide testing capability using manual override buttons.
   3. Each low-voltage digital communication link to support up to 64 ballasts or LED drivers capable of NFPA 70 Class 1 or Class 2 installation.

2.04 CONTROL STATIONS

A. Provide control stations with configuration as indicated or as required to control the loads as indicated.

B. Wired Control Stations:
   1. General Requirements:
      a. Power: Class 2 (low voltage).
      b. UL listed.
      c. Provide faceplates with concealed mounting hardware.
      d. Borders, logos, and graduations to use laser engraving or silk-screened graphic process that chemically bonds graphics to faceplate, resistant to removal by scratching and cleaning.
   2. Multi-Scene Wired Control:
      a. General Requirements:
         1) Allows control of any devices part of the lighting control system.
         2) Allows for easy reprogramming without replacing unit.
         3) Replacement of units does not require reprogramming.
         4) Communications: Utilize RS485 wiring for low-voltage communication.
         5) Software Configuration:
            (a) Customizable control station device button functionality:
               (1) Buttons can be programmed to perform single defined action.
               (2) Buttons can be programmed to perform defined action on press and defined action on release.
               (3) Buttons can be programmed using conditional logic off of a state variable such as time of day or partition status.
               (4) Buttons can be programmed to perform automatic sequence of defined actions.
               (5) Capable of deactivating select keypads to prevent accidental changes to light levels.
               (6) Buttons can be programmed for raise/lower of defined loads.
               (7) Buttons can be programmed to toggle defined set of loads on/off.
         6) Status LEDs:
            (a) Upon button press, LEDs to immediately illuminate.
            (b) LEDs to reflect the true system status. LEDs to remain illuminated if the button press was properly processed or LEDs to turn off if the button press was not processed.
            (c) Support logic that defines when LED is illuminated:
               (1) Scene logic (logic is true when all zones are at defined levels).
               (2) Room logic (logic is true when at least one zone is on).

(3) Pathway logic (logic is true when at least one zone is on).
(4) Last scene (logic is true when spaces are in defined scenes).

b. Wired Keypads

1) Communications: Utilize RS485 wiring for low-voltage communications link.
2) Mounting: Wallbox or low-voltage mounting bracket; provide wall plates with concealed mounting hardware.
3) Button/Engraving Backlighting:
   (a) Utilize backlighting for buttons and associated engraving to provide readability under all light conditions.
   (b) Backlight intensity adjustable via programming software.
4) Design keypads to allow field-customization of button color, configuration, and engraving using field-changeable replacement kits.
5) Contact Closure Interface: Provide two contact closure inputs on back of unit which provide independent functions from front buttons; accepts both momentary and maintained contact closures.
6) Terminal block inputs to be over-voltage and miswire-protected against wire reversals and shorts.
7) Provide integral infrared receiver for personal control.

c. Wired Keypads
1) Mounting: Wallbox provide wall plates with concealed mounting hardware.
2) Design keypads to allow field-customization of button color, configuration, and engraving using field-changeable replacement kits.
3) Contact Closure Interface: Provide two contact closure inputs on back of unit which provide independent functions from front buttons; accepts both momentary and maintained contact closures.
4) Terminal block inputs to be over-voltage and miswire-protected against wire reversals and shorts.

d. Wired Keypads*;*
Mounting: Wallbox provide wall plates with concealed mounting hardware.
1) Button/Engraving Backlighting:
   (a) Utilize backlighting for buttons and associated engraving to provide readability under all light conditions.
   (b) Backlight intensity adjustable via programming software.
2) Design keypads to allow field-customization of button color, configuration, and engraving using field-changeable replacement kits.
3) Contact Closure Interface: Provide two contact closure inputs on back of unit which provide independent functions from front buttons; accepts both momentary and maintained contact closures.

4) Terminal block inputs to be over-voltage and miswire-protected against wire reversals and shorts.

3. Single-Scene or Zoned Wired Control:
   a. Turn an individual fixture or group of fixtures on and off.
   b. Raise and lower light levels.
   c. Recall favorite light levels.
4. Four-Button Preset Wallstation:
   a. Recall four scenes plus all on or all off for one group of fixtures.
   b. Master raise/lower control for entire group of fixtures.
   c. Integral IR receiver for personal control.
   d. Immediate local LED response upon button activation to indicate that a system command has been requested.
5. Wired Keyswitch:
   a. Allows control of any devices part of the lighting control system.
   b. Utilize RS485 wiring for low-voltage communication.
   c. Functionality:
      1) Allows for easy reprogramming without replacing unit.
      2) Requires key insertion to activate actions.
   d. Software Configuration:
      1) Customizable control station device button functionality:
         (a) Key positions can be programmed to perform single defined action.
         (b) Key positions can be programmed using conditional logic off of a state variable such as time of day or partition status.

C. Wireless (Radio Frequency) Controls:
1. Product(s):
   a. -Button Control
   b. 2-Button Control with Night Light
   c. 2-Button with Raise/Lower Control
   d. 3-Button Control
   e. 3-Button with Raise/Lower Control
   f. 3-Button with Raise/Lower Control and Night Light
   g. 4-Button Control
   h. Single Pedestal
   i. Double Pedestal
   j. Triple Pedestal
   k. Quadruple Pedestal
   l. Screw Mounting Kit
   m. Wallbox Adapter
2. Communicates via radio frequency to compatible dimmers, switches, and plug-in modules.
3. Does not require external power packs, power or communication wiring.
4. Allows for easy reprogramming without replacing unit.
5. Button Programming:
   a. Single action.
   b. Toggle action.
   c. Defined action on press and defined action on release.
6. Includes LED to indicate button press or programming mode status.
7. Mounting:
   a. Capable of being mounted with a table stand or directly to a wall under a faceplate.

b. Faceplates: Provide concealed mounting hardware.

8. Power: Battery-operated with minimum ten-year battery life.

D. Infrared Handheld Controls:

1. Designed for use in conjunction with compatible infrared receiver and lighting control; compatibility dependent on that receiver, not transmitter.
2. Learnable by other variable frequency remote controls.

2.05 LOW-VOLTAGE CONTROL INTERFACES

A. Provide low-voltage control interfaces as indicated or as required to control the loads as indicated.

B. UL listed.

C. Contact Closure Interface:

1. The contact closure input device to accept both momentary and maintained contact closures.
2. The contact closure output device can be configured for maintained or pulsed outputs.
3. Contact closure can be programmed using conditional logic off of a state variable such as time of day or partition status.

D. Wallbox Input Closure Interface:

1. Mounts in wallbox behind contact closure keypad to provide interface for up to eight contact closure inputs.
2. The contact closure input device to accept both momentary and maintained contact closures.

E. RS232 and Ethernet Interface:

1. Provide ability to communicate via Ethernet or RS232 to audiovisual equipment, touchscreens, etc.
2. Provide control of:
   a. Light scene selections.
   b. Fine-tuning of light scene levels with raise/lower.
   c. Shade group presets.
   d. Fine-tuning of shade preset levels with raise/lower.
   e. Simulate system wall station button presses and releases.
3. Provide status monitoring of:
   a. Light scene status.
   b. Shade group status.
   c. Wall station button presses and releases.
   d. Wall station LEDs.
4. Provide ability to send custom output strings.

F. DMX Interface:

1. Provide ability to:
   a. Map a single zone intensity to a single DMX512 lighting channel.
   b. Map a single zone intensity to three DMX512 channels for RGB/CMY color control.
   c. Map a single zone intensity to a single DMX512 integration channel.
   d. Smoothly transition from one color to another in a cross fade.
   e. Automatically sequence through a variety of colors.
   f. Download, program, and customize a color wheel for each unit.

G. Sensor Modules:

1. Wired Modules:
   a. Provide wired inputs for:
      1) Occupancy sensors.

2) Daylight sensors.
3) IR receivers for personal control.
4) Digital ballast wall stations.

2. Wireless Modules:
   a. Provide wireless communication inputs for:
      1) Occupancy sensors.
      2) Daylight sensors.
      3) Wireless controller.
   b. RF Range: 30 feet (9 m) between sensor and compatible RF receiving devices.
   c. RF Frequency: 434 MHz; operates in FCC governed frequency spectrum for periodic operation; continuous transmission spectrum is not permitted.
3. Communicate sensor information to wired low-voltage digital link for use by compatible devices.

2.06 WIRED SENSORS

A. Wired Occupancy Sensors:
   1. General Requirements:
      a. Connects directly to compatible ballasts and modules without the need of a power pack or other interface.
      b. Turns off or reduces lighting automatically after reasonable time delay when a room or area is vacated by the last person to occupy the space.
      c. Accommodates all conditions of space utilization and all irregular work hours and habits.
      d. Comply with UL 94.
      e. Self-Adaptive Sensors: Continually adjusts sensitivity and timing to ensure optimal lighting control for any use of the space; furnished with field-adjustable controls for time delay and sensitivity to override any adaptive features.
      f. Provide capability to:
         1) Add additional timeout system-wide without need to make local adjustment on sensor.
         2) Group multiple sensors.
      g. Power Failure Memory: Settings and learned parameters to be saved in non-volatile memory and not lost should power be interrupted and subsequently restored.
      h. Furnished with all necessary mounting hardware and instructions.
      i. Class 2 devices.
      j. Ceiling-Mounted Sensors: Indicate viewing directions on mounting bracket.
      k. Wall-Mounted Sensors: Provide swivel-mount base.
      l. Color: White.
   2. Wired Passive Infrared Sensors:
      a. Utilize multiple segmented lens, with internal grooves to eliminate dust and residue build-up.
      b. Ceiling-Mounted Sensors: Provide customizable mask to block off unwanted viewing areas.
         1) timeout; customizable mask for aisle and end of aisle applications.
   3. Wired Ultrasonic Sensors:
      a. Utilize an operating frequency of 32 kHz or 40 kHz, crystal-controlled to operate within plus/minus 0.005 percent tolerance.

4. Wired Dual Technology Sensors:
    a. Passive Infrared: Utilize multiple segmented lens, with internal grooves to eliminate dust and residue build-up.
    b. Ultrasonic: Utilize an operating frequency of 32 kHz or 40 kHz, crystal-controlled to operate within plus/minus 0.005 percent tolerance.
    c. Ceiling-Mounted Sensors: Provide customizable mask to block off unwanted viewing areas.
    d. Isolated Relay: Provide an internal additional isolated relay with Normally Open, Normally Closed, and Common outputs for use with HVAC control, Data Logging and other control options where indicated.
    e. Integral Photocell: Provide an integral photocell with adjustable sensitivity to prevent lights from turning on when there is sufficient natural light where indicated.

B. Sensor Power Packs:
1. Provide sensor power packs where required for power connection to sensors.
2. For ease of mounting, installation and future service, power pack(s) to be able to mount through a 1/2 inch knockout in a standard electrical enclosure and be an integrated, self-contained unit consisting internally of an isolated load switching control relay and a transformer to provide low-voltage power. Transformer to provide power to a minimum of three sensors.
3. Plenum-rated.
4. Control Wiring Between Sensors and Control Units: Class 2, 18-24 AWG, stranded UL Classified, PVC insulated or TEFLON jacketed cable suitable for use in plenums, where applicable.

C. Infrared Receivers:
1. Use Class 2 wiring for low voltage communication.
2. Can be replaced without reprogramming.
3. 360 degree reception of wireless infrared remote controls.
4. Immediate local LED response upon reception of handheld transmitter communication.
5. Mountable on lighting fixtures or recessed acoustical ceiling tiles.
6. Constructed via sonic welding.
7. Color: White.

D. Wired Daylight Sensors:
1. Digital Interior Daylight Sensor:
    a. Use Class 2 wiring for low voltage communication.
    b. Can be replaced without reprogramming.
    c. Open-loop basis for daylight sensor control scheme.
    d. Stable output over temperature from 32 degrees F (0 degrees C) to 104 degrees F (40 degrees C).
    e. Partially shielded for accurate detection of available daylight to prevent fixture lighting and horizontal light component from skewing sensor detection.
    f. Provide linear response from 0 to 500 footcandles.
    g. Integral IR receiver for personal control.
    h. Mountable on lighting fixtures or recessed acoustical ceiling tiles.
    i. Constructed via sonic welding.
    j. Color: White.

2. Daylight Control Package:
    a. Controller:
        1) Automatically switches a dry contact according to changes in ambient light levels.
        2) Fully adjustable separate high and low setpoints, with an adjustable dead band between set points to prevent unwanted cycling.
        3) Input time delay to prevent unwanted cycling due to intermittent light level fluctuations.
        4) Signal/setpoint and relay status indication.
        5) Sensor calibration input.
    b. Sensors:
        1) Class 2, three-wire analog devices.
        2) Provision for zero or offset based signal.

E. Infrared Partition Sensors:
1. Provide contact closure based on status of the partition wall (open/close) enabling automatic linking of controls.

2.07 WIRELESS SENSORS

A. General Requirements:
1. Operational life of 10 years without the need to replace batteries when installed per manufacturer's instructions.
2. Communicates directly to compatible RF receiving devices through use of a radio frequency communications link.
3. Does not require external power packs, power wiring, or communication wiring.
4. Capable of being placed in test mode to verify correct operation from the face of the unit.
5. RF Range: 30 feet (9 m) between sensor and compatible RF receiving device(s).
6. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of 47 CFR 15, for Class B application.

B. Wireless Occupancy/Vacancy Sensors:
1. General Requirements:
    a. Provides a clearly visible method of indication to verify that motion is being detected during testing and that the unit is communicating to compatible RF receiving devices.
    b. Utilize multiple segmented lens, with internal grooves to eliminate dust and residue build-up.
    c. Sensing Mechanism: Passive infrared coupled with technology for sensing fine motions; Lutron XCT Technology. Signal processing technology detects fine-motion passive infrared (PIR) signals without the need to change the sensor's sensitivity threshold.
    d. Provide optional, readily accessible, user-adjustable controls for timeout, automatic/manual-on, and sensitivity.
    e. Turns off lighting after reasonable and adjustable time delay once the last person to occupy the space vacates a room or area. Provide adjustable timeout settings of 1, 5, 15, and 30 minutes.
    f. Capable of turning dimmer's lighting load on to an optional locked preset level selectable by the user. Locked preset range to be selectable on the dimmer from 1 percent to 100 percent.
    g. Color: White.

h. Provide all necessary mounting hardware and instructions for both temporary and permanent mounting.
i. Provide temporary mounting means to allow user to check proper performance and relocate as needed before permanently mounting sensor. Temporary mounting method to be design for easy, damage-free removal.
j. Sensor lens to illuminate during test mode when motion is detected to allow installer to verify coverage prior to permanent mounting.
k. Ceiling-Mounted Sensors:
1) Provide surface mounting bracket compatible with drywall, plaster, wood, concrete, and compressed fiber ceilings.
2) Provide recessed mounting bracket compatible with drywall and compressed fiber ceilings.
3) Provide customizable mask to block off unwanted viewing areas.
l. Wall-Mounted Sensors: Provide wall or corner mounting brackets compatible with drywall and plaster walls.

2. Wireless Combination Occupancy/Vacancy Sensors:
a. Ceiling-Mounted Sensors: Programmable to operate as an occupancy sensor (automatic-on and automatic-off), an occupancy sensor with low light feature (automatic-on when less than one footcandle of ambient light available and automatic-off), or a vacancy sensor (manual-on and automatic-off).
b. Wall-Mounted Sensors: Programmable to operate as an occupancy sensor (automatic-on and automatic-off), or a vacancy sensor (manual-on and automatic-off).

C. Wireless Daylight Sensors:
1. Open-loop basis for daylight sensor control scheme.
2. Stable output over temperature from 32 degrees F (0 degrees C) to 104 degrees F (40 degrees C).
3. Partially shielded for accurate detection of available daylight to prevent fixture lighting and horizontal light component from skewing sensor detection.
4. Provide linear response from 0 to 10,000 footcandles.
5. Color: White.
6. Mounting:
a. Provide surface mounting bracket compatible with drywall, plaster, wood, concrete, and compressed fiber ceilings.
b. Provide all necessary mounting hardware and instructions for both temporary and permanent mounting.
c. Provide temporary mounting means to allow user to check proper performance and relocate as needed before permanently mounting sensor. Temporary mounting method to be design for easy, damage-free removal.
7. Meets CAL TITLE 24 P6 requirements.

2.08 ACCESSORIES

A. Emergency Lighting Interface:
1. Provides total system listing to UL 924 when used with lighting control system.
2. Senses all three phases of building power.
3. Accepts a contact closure input from a fire alarm control panel.

B. Provide power supplies as indicated or as required to power system devices and accessories.

1. Product(s):
    a. Junction box-mounted power supply for shades, keypads, and accessories, and for providing additional low voltage power to communication link with miswire and thermal protection.
    b. Plug-in power supply for shades, drapery drive units, keypads, and accessories, and for providing additional low voltage power to communication linkwith miswire protection; powered from standard receptacle using cord 6 feet (1.8 m) in length; complies with DOE Level VI regulation.
    c. Ten output power supply panel for shades, drapery drive units, keypads and accessories, and for providing additional low voltage power to communication link no replaceable fuses required for overload/miswire protection; contains DOE Level VI Compliant power supplies.
    d. Power supply for keypads and accessories (not for shades/window treatments), and for providing additional low voltage power to communication link

C. Provide locking covers for controls where indicated.
    1. Reversible to allow lock to be located on either side of control.
    2. Compatible with IR controls.
    3. Does not reduce specified IR range by more than 50 percent of its original specification.

2.09 SOURCE QUALITY CONTROL

A. See Section *01 4000 - Quality Requirements*, for additional requirements.
B. Factory Testing*; Lutron Standard Factory Testing*:
    1. Perform full-function factory testing on all completed assemblies. Statistical sampling is not acceptable.
    2. Perform full-function factory testing on 100 percent of all ballasts and LED drivers.
    3. Perform factory audit burn-in of all dimming assemblies and panels at 104 degrees F (40 degrees C) at full load for two hours.
    4. Perform factory burn-in of 100 percent of all ballasts at 104 degrees F (40 degrees C).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.
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.

3.02 INSTALLATION

A. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130.
B. Install products in accordance with manufacturer's instructions.
C. Define each dimmer/relay load type, assign each load to a zone, and set control functions.
D. Sensor Locations:
    1. Where Lighting Control Manufacturer Sensor Layout and Tuning service is specified in Part 2 under "LIGHTING CONTROL SYSTEM - GENERAL REQUIREMENTS", locate sensors in accordance with layout provided by Lighting Control Manufacturer. Lighting Control Manufacturer may direct Contractor regarding sensor relocation should conditions require a deviation

from locations indicated. Where Lighting Control Manufacturer Sensor Layout and Tuning service is not specified, locate sensors in accordance with Drawings.

2. Sensor locations indicated are diagrammatic. Within the design intent, reasonably minor adjustments to locations may be made in order to optimize coverage and avoid conflicts or problems affecting coverage, in accordance with manufacturer's recommendations.

E. Mount exterior daylight sensors to point due north with constant view of daylight.

F. Ensure that daylight sensor placement minimizes sensor view of electric light sources. Locate ceiling-mounted and luminaire-mounted daylight sensors to avoid direct view of luminaires.

G. Lamp Burn-In: Operate lamps at full output for prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.

H. Lamp Lead Lengths: Do not exceed 3 feet (0.9 m) for T4 4-pin compact and T5 BIAX lamps and 7 feet (2.1 m) for T5, T5-HO, T8 U-bend, and T8 linear fluorescent lamps.

I. LED Light Engine/Array Lead Length: Do not exceed 100 feet (31 m).

3.03 FIELD QUALITY CONTROL

A. Manufacturer's Startup Services*; Lutron Standard Startup Services*:

1. Manufacturer's authorized Service Representative to conduct minimum of two site visits to ensure proper system installation and operation.
2. Conduct Pre-Installation visit to review requirements with installer as specified in Part 1 under "Administrative Requirements".
3. Conduct second site visit upon completion of lighting control system to perform system startup and verify proper operation:
   a. Where Lighting Control Manufacturer Sensor Layout and Tuning service is specified in Part 2 under “LIGHTING CONTROL SYSTEM – GENERAL REQUIREMENTS”, authorized Service Representative to verify sensor locations, in accordance with layout provided by Lighting Control Manufacturer; Lighting Control Manufacturer may direct Contractor regarding sensor relocation should conditions require a deviation from locations indicated.
   b. Verify connection of power wiring and load circuits.
   c. Verify connection and location of controls.
   d. Address devices.
   e. Verify system operation control by control.
   f. Verify proper operation of manufacturer's interfacing equipment.
   g. Configure initial groupings of ballast for wall controls, daylight sensors and occupancy sensors.
   h. Provide initial rough calibration of sensors; fine-tuning of sensors is responsibility of Contractor unless provided by Lighting Control Manufacturer as part of Sensor Layout and Tuning service where specified in Part 2 under "LIGHTING CONTROL SYSTEM - GENERAL REQUIREMENTS".
   i. Train Owner's representative on system capabilities, operation, and maintenance, as specified in Part 3 under "Closeout Activities".
   j. Obtain sign-off on system functions.

B. Correct defective work adjust for proper operation, and retest until entire system complies with contract documents.

3.04 ADJUSTING

A. On-Site Scene and Level Tuning*; Lutron LSC-AF-VISIT*: Include *additional* costs for Lighting Control Manufacturer to visit site to conduct meeting with Owner's representative to make required lighting adjustments to the system for conformance with original design intent.

B. Sensor Fine-Tuning: Where Lighting Control Manufacturer Sensor Layout and Tuning service is specified in Part 2 under “LIGHTING CONTROL SYSTEM – GENERAL REQUIREMENTS”, Lighting Control Manufacturer to provide up to two additional post-startup on-site service visits for fine-tuning of sensor calibration. Where Lighting Control Manufacturer Sensor Layout and Tuning service is not specified, Contractor to provide fine-tuning of sensor calibration.

3.05 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.06 COMMISSIONING

A. Title 24 Acceptance Testing Service*; Lutron LSC-SPV-DOC-T24*: Include additional costs for Lighting Control Manufacturer to perform lighting control acceptance testing in accordance with CAL TITLE 24 P6. Submit required documentation.

3.07 CLOSEOUT ACTIVITIES

A. Demonstration:

1. On-Site Performance-Verification Walkthrough*; Lutron LSC-WALK*: Include additional costs for lighting control manufacturer to provide on-site demonstration of system functionality to facility representative.

B. Training:

1. Include services of manufacturer's authorized Service Representative to perform on-site training of Owner's personnel on operation, adjustment, and maintenance of lighting control system as part of standard system start-up services.

3.08 PROTECTION

A. Protect installed products from subsequent construction operations.

END OF SECTION

SECTION 26 24 13 – SWITCHBOARDS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes

1. Provide all labor, materials and equipment necessary to complete the installation required for the items specified under this Section, including but not limited to switchboards and large distribution panels.

B. Related sections

1. Where items specified in other Division 26 sections conflict with the requirements of this Section, the most stringent requirement shall govern.
    a. 26 05 26 – Grounding and Bonding for Electrical Systems
    b. 26 28 11 – Overcurrent Protection Devices
2. The requirements of this Section apply to all Division 26 work, as applicable.
3. Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified:

1. ANSI - American National Standards Institute
    a. C12.16; Solid State Electricity Metering
    b. C57.13; Instrument Transformers
2. CCR –California Code of Regulations, Title 24
    a. Part 3 -California Electrical Code(CEC); NFPA 70 National Electrical Code (NEC) with California amendments
3. Federal Specification
    a. W-C-37; Circuit Breakers, Molded Case, Branch Circuit and Service
4. NECA –National Electrical Contractors Association
    a. 400, Recommended Practice for Installing and Maintaining Switchboards
5. NEMA –National Electrical Manufacturer’s Association
    a. AB 1; Molded Case Circuit Breakers and Molded Case Switches
    b. KS; Fused and Non-fused Switches
    c. PB 2; Deadfront Distribution Switchboards, File E8681
    d. PB 2.1; Proper Handling, Installation, Operation and Maintenance of Deadfront Switchboards Rated 600 Volts or Less

e. PB 2.2; Application Guide for Ground Fault Protective Devices for Equipment

6. UL -Underwriters Laboratories, Inc.
   a. UL 50; Cabinets and Boxes
   b. UL 98; Enclosed and Dead Front Switches
   c. UL 489; Molded Case Circuit Breakers
   d. UL 891; Dead-Front Switchboards
   e. UL 943; Ground Fault Circuit Interrupters
   f. UL 977; Fused Power Circuit Devices

1.03 SUBMITTALS

A. Submit manufacturer's data for materials specified within this Section in accordance to Section 26 05 00.

B. Shop Drawings shall indicate front and side enclosure elevations with overall dimensions shown; conduit entrance locations and requirements; nameplate legends; one-line diagrams; equipment schedule; and switchboard instrument details.

1.04 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the materials specified herein shall be new and unused, bearing UL labels where applicable.

B. The manufacturing facility shall be registered by Underwriters Laboratories Inc. to the International Organization for Standardization ISO 9002 Series Standards for quality.

C. Installation shall conform to NECA 400-1998, Recommended Practice for Installing and Maintaining Switchboards unless otherwise specified.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect, and handle products in conformance with manufacturer's recommended practices as outlined in applicable Installation and Maintenance Manuals.

B. Each switchboard section shall be delivered in individual shipping splits for ease of handling. They shall be individually wrapped for protection and mounted on shipping skids.

C. Store in a clean, dry space. Maintain factory protection and/or provide an additional heavy canvas or heavy plastic cover to protect structure from dirt, water, construction debris, and traffic. Where applicable, provide adequate heating within enclosures to prevent condensation.

D. Handle in accordance with NEMA PB 2.1 and manufacturer's written instructions. Lift only by lifting means provided for this express purpose. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Square D, Cutler-Hammer or approved equal.

2.02 MATERIAL

A. General

1. Utility Metering Compartment: The utility current transformer compartment shall be connected for hot sequence metering. The compartment shall comply with EUSERC and/or the local utility company specifications.
2. Switchboards shall be rated with a minimum short circuit current rating at listed voltage as shown on Drawings.
3. All unused spaces provided, unless otherwise specified, shall be fully bussed and equipped for future devices, including all appropriate connectors and mounting hardware.
4. Enclosure shall be of NEMA type shown on Drawings.
5. Sections shall be aligned front and rear.
6. Sections shall be aligned front and rear.
7. The switchboard frame shall be of formed steel rigidly bolted together to support all cover plates, bussing and component devices during shipment and installation.
8. Each switchboard section shall have an open bottom and an individually removable top plate for installation and termination of conduit.
9. The switchboard enclosure shall be painted on all exterior surfaces. The paint finish shall be a medium gray, ANSI #49, applied by the electro-deposition process over an iron phosphate pre-treatment.
10. All front covers shall be screw removable with a single tool and all doors shall be hinged with removable hinge pins.
11. Top and bottom conduit areas shall be clearly indicated on shop drawings.
12. Provide 1” high by 3” wide engraved laminated nameplates for each device. Furnish black letters on a white background for all voltages.
13. Bus Composition shall be plated copper. Plating shall be applied continuously to all bus work. The switchboard bussing shall be of sufficient cross-sectional area to meet UL 891 temperature rise requirements. The phase and neutral through-bus shall have an ampacity as shown in the plans. For 4-wire systems, the neutral shall be of equivalent ampacity as the phase bus bar. Tapered bus is not acceptable. Full provisions for the addition of future sections shall be provided. Bussing shall include all necessary hardware to accommodate splicing for future additions.
14. Bus Connections shall be bolted with Grade 5 bolts and conical spring washers.

15. Ground Bus shall be sized per CEC/NEC and UL 891 Tables 25.1 and 25.2 and shall extend the entire length of the switchboard. Provisions for the addition of future sections shall be provided.
16. Square-D I-Line or equivalent distribution bussing with the following characteristics where so noted on Drawings.
    a. Circuit breaker(s) shall be group mounted plug-on with mechanical restraint on a common pan or rail assembly, facilitating ease of installation of future devices.
    b. The interior shall have three bus bars stacked and aligned vertically with glass reinforced polyester insulators laminated between phases. The molded polyester insulators shall support and provide phase isolation to the entire length of bus., providing side-by-side mounting of breakers.
    c. Circuit breaker(s) equipped with line terminal jaws shall not require additional external mounting hardware. Circuit breaker(s) shall be held in mounted position by a self-contained bracket secured to the mounting pan by fasteners. Circuit breaker(s) of different frame sizes shall be capable of being mounted across from each other.
    d. Line-side circuit breaker connections are to be jaw type, whereby clamping forces are increased under faulted conditions.
    e. All unused spaces provided, unless otherwise specified, shall be fully equipped for future devices, including all appropriate connectors and mounting hardware.

B. Incoming main devices shall of type and accessories as shown on Drawings.
    1. Circuit Breakers
        a. Circuit breaker shall be of type, rating and poles shown on Drawings per Section 26 28 11 – Overcurrent Protection Devices.
    2. Fusible Switches
        a. Single main group mounted through 800 A.
        b. Fusible main switch shall be group mounted plug-on with mechanical restraint. No additional hardware shall be required to mount the fusible switch into the switchboard.
        c. Switch shall have dual cover interlocks designed to prevent the opening of the cover when the switch is ON. The cover interlock shall prevent the switch from being turned ON with the cover open. Interlock may be manually overridden for testing purposes. Switch cover shall include a means by which the cover can be padlocked in the closed position. The operating handle shall feature positive lock-off means by providing provisions for (3) 0.375” padlocks.
        d. Load side fusible switch connections shall be jaw type.
    3. Incoming Lug Only (Distribution only, non-service entrance)
        a. Incoming conductors shall terminate at lug landing pads rated per Drawings.

b. All lugs shall be UL Listed to accept solid and/or stranded copper conductors only. Lugs shall be suitable for 90° C rated wire, sized according to the 75° C temperature rating in the NEC.

c. Provide compression type lugs to accommodate the conductor shown on the associated drawings.

C. Distribution section devices shall of type and accessories as shown on Drawings.

1. Group mounted or individually mounted as shown on Drawings.

2. All circuit breakers shall be installed in a twin mount configuration where allowed by the manufacturer with prepared space unless otherwise noted.

3. All distribution circuit breakers shall be thermal-magnetic molded case, unless otherwise noted on Drawings.

4. Circuit breaker shall be of type, rating and poles shown on Drawings per Section 26 28 11 – Overcurrent Protection Devices.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine switchboard to provide adequate clearances for installation.

B. Check that concrete pads are level and free of irregularities.

C. Begin work only after unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. Install switchboard in location shown on Drawings, in accordance with manufacturer's written instructions and NEMA PB 2.1. Anchor to resist seismic forces as indicated on Drawings and in accordance with OSHPD's anchorage requirements. Provide all testing and inspections requirements by inspecting authority.

B. Installation shall conform to NECA 400 where not specified under this Division.

C. Tighten accessible bus connection and mechanical fasteners after placing switchboard.

3.03 FIELD QUALITY CONTROL

A. Obtain the services of an independent testing company who shall provide quality control and adjustments as well as tests.

B. Inspect complete installation for physical damage, proper alignment, anchorage and grounding prior to energizing.

C. Measure the insulation resistance of each bus section phase-to-phase and phase-to-ground for one minute each at 1000Vdc; acceptable insulation resistance is 1 megaohm. Also, refer to manufacturer's specifications for specific testing procedures and values.

D. Check tightness of accessible bolted bus joints using a calibrated torque wrench per manufacturer's specifications.

E. Physically test key interlock systems to check for proper functionality.

F. Test ground fault systems by push-to-test button.

G. Check and set where required all protective device settings in accordance with approved coordination study settings and conduct ground fault acceptance tests.

3.04 ADJUSTING

A. Adjust all operating mechanisms for free mechanical movement per manufacturer's specifications.

B. Tighten bolted bus connections in accordance with manufacturer's instructions.

C. Adjust circuit breaker trip and time delay settings to values indicated by Engineer.

D. Main circuit breaker ground fault setting shall be per CEC/NEC 230-95(a).

3.05 CLEANING

A. Touch up scratched or marred surfaces to match original finish

END OF SECTION

SECTION 26 24 16 – PANELBOARDS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes

1. Provide all labor, materials and equipment necessary to complete the installation required for the items specified under this Section, including but not limited to panelboards.

B. Related sections

1. Where items specified in other Division 26 sections conflict with the requirements of this Section, the most stringent requirement shall govern.
    a. 26 05 26 – Grounding and Bonding for Electrical Systems
    b. 26 28 11 – Overcurrent Protection Devices
2. The requirements of this Section apply to all Division 26 work, as applicable.
3. Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified:

1. CCR –California Code of Regulations, Title 24
    a. Part 3 -California Electrical Code(CEC); NFPA 70 National Electrical Code (NEC) with California amendments
2. Federal Specification
    a. W-C-375; Circuit Breakers, Molded Case, Branch Circuit and Service
3. NECA –National Electrical Contractors Association
    a. 407, Recommended Practice for Installing and Maintaining Panelboards
4. NEMA –National Electrical Manufacturer’s Association
    a. AB 1; Molded Case Circuit Breakers
    b. PB 1; Panelboards
    c. PB 1.1; Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less
5. UL -Underwriters Laboratories, Inc.
    a. 50; Cabinets and Boxes
    b. 67; Panelboards
    c. 98; Enclosed and Dead Front Switches

d. 489; Molded-Case Circuit Breakers and Circuit Breaker Enclosures

e. 891; Dead-Front Switchboards

f. 943; Ground Fault Circuit Interrupters

g. 977; Fused Power Circuit Devices50; Enclosures for Electrical Equipment

1.03 SUBMITTALS

A. Submit manufacturer's data for materials specified within this Section in accordance to Section 26 05 00.

B. Submittal shall show the following information: circuit breaker numbering, circuit breaker type and short circuit rating, provisions for future circuit breakers, bussing, including neutral and ground, ratings and enclosure dimensions and trims.

1.04 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the materials specified herein shall be new and unused, bearing UL labels where applicable.

1.05 DELIVERY, STORAGE AND HANDLING

A. Handle carefully to avoid damage to internal components, enclosure and finish.

B. Store in a clean, dry environment. Maintain factory packaging and, if required, provide an additional cover to protect enclosure in harsh environments.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Square D, Cutler-Hammer or approved equal.

2.02 MATERIALS

A. Panelboards

1. Interior

a. Shall be factory-assembled with voltage, ampacity, and short circuit rating as shown in Drawings.

b. Provide 1 continuous copper bus bar per phase. Each bus bar shall have sequentially phase branch circuit connectors suitable for plug-on or bolt-on branch circuit breakers. The bussing shall be fully rated. Panelboard bus current rating shall be determined by heat-rise tests conducted in accordance with UL 67. Panelboards shall be suitable for use as Service Equipment when application requirements comply with UL 67 and CEC/NEC 230.F and 230.G.

c. All current-carrying parts shall be insulated from ground and phase-to-phase by high dielectric strength material.

d. Interior trim shall be of dead-front construction to shield user from energized parts. Dead-front trims shall have pre-formed twist-out covering unused mounting spaces.

e. Nameplates shall contain system information and catalog number or factory order number. Interior wiring diagram, neutral wiring diagram, UL Listed label and short circuit current rating shall be displayed on the interior.

f. Main and sub-feed circuit breakers shall be vertical mounted. Interior leveling provisions shall be provided for flush mounted applications.

2. Main Circuit Breaker

   a. Circuit breaker shall be of type, rating and poles shown on Drawings per Section 26 28 11 – Overcurrent Protection Devices.

3. Branch Circuit Breakers

   a. Circuit breakers shall be of type, rating and poles shown on Drawings per Section 26 28 11 – Overcurrent Protection Devices.

4. Enclosures

   a. Type NEMA 1 Boxes

      1) Boxes shall be galvanized steel constructed in accordance with UL 50 requirements. Galvanealed steel will not be acceptable.

      2) Boxes shall have removable endwalls with knockouts located on one end. Boxes shall have welded interior mounting studs. Interior mounting brackets are not required.

      3) Box width shall be 20 in wide.

   b. Type NEMA 1 Fronts

      1) Front shall meet strength and rigidity requirements per UL 50 standards. Front shall have ANSI 49 gray enamel electrodeposited over cleaned phosphatized steel.

      2) Fronts shall be hinged 1-piece with door. Mounting shall be as indicated in Drawings.

      3) Panelboards rated 225 amperes and below shall flat fronts with concealed door hinges and trim screws. Front shall not be removable with the door locked. Panelboards rated above 225 amperes shall have fronts with trim clamps and concealed door hinges. Front doors shall have rounded corners and edges shall be free of burrs.

      4) Front shall have cylindrical tumbler type lock with catch and spring-loaded stainless steel door pull. All lock assemblies shall be keyed alike. Two (2) keys shall be provided with each lock. A clear plastic directory cardholder shall be mounted on the inside of door.

   c. Type NEMA 3R, 5, and 12

      1) Enclosures shall be constructed in accordance with UL 50 requirements. Enclosures shall be painted with ANSI 49 gray enamel electrodeposited over cleaned phosphatized steel.

2) All doors shall be gasketed and equipped with a tumbler type vault lock. All lock assemblies shall be keyed alike. 2 keys shall be provided with each lock. A clear plastic directory cardholder shall be mounted on the inside of door.

3) Maximum enclosure dimensions shall not exceed 20 in wide and 6.5 in deep.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's written instructions and NEMA PB 1.1.

B. Installation shall conform to NECA 407 where not specified under this Division.

C. Anchor panelboards to structural members and as shown on Drawings. Provide additional support as required. Anchor freestanding distribution panels to concrete pad.

D. Mount panelboards level and plumb.

E. Install flush mounted panel backbox front edges flush with finished wall. Where flush panel backbox is deeper than wall depth, install closing trim of wood or metal to provide a finished trim.

F. Where panelboard is flush in wall, provide one ¾" conduit stub into accessible ceiling above for every 5 spare circuit breaker or available space.

G. After installation, make all feeder connections to circuit breaker load side lugs and incoming secondary feeders.

3.02 FIELD QUALITY CONTROL

A. Inspect complete installation prior to energizing for physical damage, proper alignment, anchorage and grounding.

B. Check tightness of bolted connections and circuit breaker connections using a calibrated torque wrench or torque screwdriver per manufacturer's written specifications.

3.03 ADJUSTING

A. Measure steady state load line currents at each panelboard feeder; rearrange panelboard circuits to balance the phase loads with 20% of each other. Maintain proper phasing for multi-wire branch circuits.

3.04 SCHEDULES

A. Fill out panelboard circuit identification card, typewritten, with list of circuits in use. Identification shall be specific with room designation and other information as necessary. For distribution panels, use engraved laminated phenolic plates showing load served.

END OF SECTION

SECTION 26 27 26 – WIRING DEVICES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes

1. Provide all labor, materials and equipment necessary to complete the installation required for the items specified under this Section, including but not limited to wiring devices.

B. Related sections

1. Where items specified in other Division 26 sections conflict with the requirements of this Section, the most stringent requirement shall govern.
    a. 26 05 26 – Grounding and Bonding for Electrical Systems
2. The requirements of this Section apply to all Division 26 work, as applicable.
3. Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified:

1. Federal Specification
    a. W-C-596; Connector, Electrical, Power, General Specification for
    b. W-S-896; Switches, Toggle (Toggle and Lock), Flush Mounted (General Specification)
2. NEMA –National Electrical Manufacturer's Association
    a. WD 1; General Color Requirements for Wiring Devices
    b. WD 6; Wiring Devices-Dimensional Requirements
3. UL -Underwriters Laboratories, Inc.
    a. 20; General-Use Snap Switches
    b. 498; Standard for Attachment Plugs and Receptacles
    c. 943; Standard for Ground-Fault Circuit-Interrupters
    d. 1449; Standard for Transient Voltage Surge Suppressors

1.03 SUBMITTALS

A. Submit manufacturer's data for materials specified within this Section in accordance to Section 26 05 00.

1.04 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the materials specified herein shall be new and unused, bearing UL labels where applicable.

PART 2 - PRODUCTS

2.01 SWITCHES

A. Wall switches

1. Specification grade, quiet, AC rated, mechanical, snap type with silver alloy contacts, and shall comply with NEMA WD-1 and Fed. Spec W-S-896.
2. Rating shall be 20A at 120/277Vac, unless otherwise shown.
3. Handles shall be nylon; color shall be compatible with adjacent wall finish.
4. Manufacturers and types
    a. Single pole, single throw
        1) Cooper Wiring Devices #CSB120, Hubbell #CSB120, or equal.
    b. Double pole, single throw
        1) Cooper Wiring Devices #CSB220, Hubbell #CSB220, or equal.
    c. Three way
        1) Cooper Wiring Devices #CSB320, Hubbell #CSB320, or equal.

B. Wall dimmer switches

1. Linear slide type dimmer with smooth and continuous square law dimming curve that complies with UL 20 and is UL listed for the specified load.
2. Dimmers shall have power failure memory to bring lights back on at same level prior to power interruption.
3. Dimmers shall incorporate air-gap switch accessible with wall plate installed.
4. Furnish dimmer switch of rating to connected loads; de-rate as required by manufacturer's information for ganged installations.
5. Coverplate shall be snap-on type with no visible attachments or fins. Color shall be compatible with adjacent wall finish.
6. Manufacturer and type
    a. Lutron Nova series or approved equal.

2.02 RECEPTACLES

A. Standards

1. Specification grade, NEMA 5-15R configuration grounding type, rated 15A at 125/250Vac that conform to NEMA WD-6 and Fed. Spec W-C-596.
2. At dedicated receptacle locations and as otherwise noted, use specification grade, NEMA 5-20R configuration grounding type, rated 20A at 125/250Vac that conform to NEMA WD-6 and when possible Fed. Spec W-C-596.
3. Specialty receptacles shall conform to NEMA WD-6 and UL standards as applicable.

B. Color

1. General purpose receptacle face shall be nylon; color shall be compatible with adjacent wall finish, unless otherwise indicated.

C. Receptacle types

1. General purpose single
    a. Provide self-grounding back and side wired with binding head staked terminal screw.
    b. Use Cooper Wiring Devices #5261, Hubbell #5261, or equal for NEMA 5-15R.
    c. Use Cooper Wiring Devices #5361, Hubbell #5361, or equal for NEMA 5-20R.
2. General purpose duplex
    a. Provide self-grounding back and side wired with binding head staked terminal screws and break-off strip for two circuit wiring.
    b. Use Cooper Wiring Devices #5262, Hubbell #5262, or equal for NEMA 5-15R.
    c. Use Cooper Wiring Devices #5362, Hubbell #5362, or equal for NEMA 5-20R.
3. Transient voltage surge suppressor (TVSS) duplex
    a. Provide 20A, 125Vac receptacle consisting of NEMA 5-20R duplex device with integral TVSS protection circuit.
    b. Provide LED indicator to verify surge protection and ground, and audible alarm to notify bad ground connection or surge protection expiration.
    c. TVSS characteristics:
        1) 400V clamping voltage.
        2) 280J energy rating.
        3) 150Vac RMS MOV rating
        4) 18kA maximum surge current in all modes (L-N, L-G and N-G)
    d. Use Cooper Wiring Devices #5362_S, no known equal.
4. Isolated ground
    a. Provide receptacle specified within this Section with equipment grounding contacts connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap.
5. Ground fault circuit interrupter (GFCI) duplex
    a. Provide 20A, 125Vac receptacle consisting of NEMA 5-20R duplex device with integral solid state sensing and signaling circuitry capable of detecting and interrupting a maximum 5mA line-to-ground fault current in approximately 1/40th of a second per UL 943.
    b. Provide visual device with trip indication, manual reset and test mechanisms per UL 943.
    c. Device shall be capable of point of use and multi-outlet protection.
    d. Use Cooper Wiring Devices #XGF20, Hubbell #GF53, or equal.

6. Hospital grade and tamper resistant
    a. Provide receptacle specified within this Section that conforms to UL 498 “Hospital Grade” requirements.
    b. Tamper resistance receptacle shall have integral protection mechanism to prevent accidental shock from foreign object contacting energized blades.
7. Special purpose
    a. Provide specification grade devices with NEMA configuration, voltage, ampacity, poles and ground provisions as noted on Drawings.

2.03 WALL PLATES

A. Interior locations
    1. Finished Areas: 0.032” stainless steel, brushed or satin finish with required number of openings for location.
    2. Exposed Areas: galvanized, raised type.

B. Exterior: die-cast copper-free aluminum, gasketed, raintight cover UL listed for exterior and wet locations while in use. Use Hubbell #WP8M (duplex), #WP26M (GFCI) or equal.

C. Screws shall match plate.

D. Tamper resistance receptacles shall have exposed screws of temper resistant type.

E. Individual, gangable wall plates are not acceptable where two or more devices are installed at one location.

PART 3 - EXECUTION

3.01 PREPARATION

A. Coordinate device heights with architectural drawings and details.

B. Locate switches on latch side of door, unless otherwise indicated.

3.02 INSTALLATION

A. Mount and align device and wall plates level and plumb. Insure wall plates fit flat against wall and tight against device without strain on plate.

B. Comply with manufacturer’s instructions regarding termination of conductors to wiring device.

C. Derate ganged dimmer switches as instructed by manufacturer and use dedicated neutrals within all dimmer circuits.

D. Provide wall plates for all outlet boxes with devices.

E. Install blank wall plates on all outlet boxes in which no device is present or installed.

END OF SECTION

SECTION 26 28 11 – OVERCURRENT PROTECTION DEVICES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes

1. Provide all labor, materials and equipment necessary to complete the installation required for the items specified under this Section, including but not limited to overcurrent protection devices.

B. Related sections

1. Where items specified in other Division 26 sections conflict with the requirements of this Section, the most stringent requirement shall govern.
2. The requirements of this Section apply to all Division 26 work, as applicable.
3. Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified:

1. CCR –California Code of Regulations, Title 24
   a. Part 3 -California Electrical Code(CEC); NFPA 70 National Electrical Code (NEC) with California amendments
2. Federal Specification
   a. W-C-375; Circuit Breakers, Molded Case, Branch Circuit and Service
3. NEMA –National Electrical Manufacturer’s Association
   a. AB 1; Molded-Case Circuit Breakers, Molded Case Switches, and Circuit-Breaker Enclosures
   b. PB 2.2; Application Guide for Ground Fault Protective Devices for Equipment
4. UL -Underwriters Laboratories, Inc.
   a. 248; Low Voltage Fuses
   b. 468; Wire Connectors
   c. 508E; IEC Type "2" Coordination Short Circuit Tests
   d. 489; Molded-Case Circuit Breakers and Circuit Breaker Enclosures
   e. 943; Standard for Ground-Fault Circuit-Interrupters

1.03 SUBMITTALS

A. Submit manufacturer’s data for materials specified within this Section in accordance to Section 26 05 00.

B. Production test of circuit breakers upon request of Engineer.

C. Submittal shall show the following information: circuit breaker numbering, circuit breaker type and short circuit rating, provisions for future circuit breakers, bussing, including neutral and ground, ratings and enclosure dimensions and trims.

1.04 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the materials specified herein shall be new and unused, bearing UL labels where applicable.

B. The manufacturing facility shall be registered by Underwriters Laboratories Inc. to the International Organization for Standardization ISO 9002 Series Standards for quality.

1.05 DELIVERY, STORAGE AND HANDLING

A. Handle carefully to avoid damage to internal components, enclosure and finish.

B. Store in a clean, dry environment. Maintain factory packaging and, if required, provide an additional cover to protect enclosure in harsh environments.

PART 2 - PRODUCTS

2.01 FUSES

A. All power distribution fuses shall be time-delay, high interrupting (200kAIC minimum) and current limiting type, unless otherwise indicated. All fuses shall be of same manufacturer and model.

1. Motor branch circuit fuses (0 – 600A): UL Class RK5 dual element, time delay type shall be size for UL 508E “Type 2” coordination for the motor controller. Coordinate fuse selection with motor starter overload relay heaters as required.

2. General purpose feeder fuses (0 – 600A): UL Class RK1 dual element, time delay type shall be size per Drawings.

B. Control and instrumentation fuses shall of type and rating as recommended by equipment manufacturer, suitable for fuse blocks or holders installation.

2.02 MOLDED CASE CIRCUIT BREAKERS

A. General

1. Circuit breakers shall be constructed using glass reinforced insulating material. Current carrying components shall be completely isolated from the handle and the accessory mounting area.

2. Circuit breakers shall have an over center, trip free, toggle operating mechanism which will provide quick-make, quick-break contact action. The circuit breaker shall have common tripping of all poles.

3. The circuit breaker handle shall reside in a tripped position between ON and OFF to provide local trip indication.

4. The maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings shall be clearly marked on face of circuit breaker after installation.
5. Circuit breakers shall have an RMS interrupting capacity not less than shown on Drawings, or if not shown shall not be less than:
    a. 25kA for 480V systems
    b. 22kA for 240V (or less) systems
6. Each circuit breaker shall be equipped with a push-to-trip button, located on the face of the circuit breaker to mechanically operate the circuit breaker tripping mechanism for maintenance and testing purposes.
7. Circuit breakers shall be equipped with UL Listed electrical accessories as noted on Drawing. Circuit breaker handle accessories shall provide provisions for locking handle in the ON and OFF position.
8. All circuit breakers shall be UL Listed for reverse connection without restrictive line and load markings and be suitable for mounting in any position.
9. Circuit breakers shall be constructed with factory installed mechanical lugs. All circuit breakers shall be UL Listed to accept field installable/removable mechanical type lugs. Lug body shall be bolted in place; snap in design not acceptable. All lugs shall be UL Listed to accept solid (not larger than #8 AWG) and/or stranded copper and aluminum conductors. Lugs shall be suitable for 90°C rated wire, sized according to the 75°C temperature rating in the CEC.
10. All circuit breakers shall be capable of accepting bus connections.

B. Thermal-Magnetic Circuit Breakers
    1. Circuit breakers shall have a permanent trip unit containing individual thermal and magnetic trip elements in each pole.
    2. Thermal trip elements shall be factory preset and sealed. Circuit breakers shall be true RMS sensing and thermally responsive to protect circuit conductor(s) in a 40°C ambient temperature.
    3. Circuit breaker frame sizes above 100 amperes shall have a single magnetic trip adjustment located on the front of the circuit breaker.
    4. Provide equipment ground fault protection where shown on Drawing with the following features.
        a. Ground fault sensing system shall be modified zero sequence sensing type and not require any external power to trip the circuit breaker.
        b. The ground fault sensing system shall be suitable for use on grounded systems. The ground fault sensing system shall be suitable for use on three-phase, three-wire circuits where the system neutral is grounded but not carried through the system or on three-phase, four-wire systems.
        c. Ground fault pickup current setting and time delay shall be field adjustable. A switch shall be provided for setting ground fault pickup point. A means to seal the pickup and delay adjustments shall be provided.

d. The ground fault sensing system shall include a ground fault memory circuit to sum the time increments of intermittent arcing ground faults above the pickup point.

e. A means of testing the ground fault system to meet the on-site testing requirements of CEC/NEC 230-95(c) shall be provided.

f. Local visual ground fault trip indication shall be provided.

g. The ground fault sensing system shall be provided with Zone Selective Interlocking (ZSI) communication capabilities compatible with other thermal magnetic circuit breakers equipped with ground fault sensing, electronic trip circuit breakers with integral ground fault sensing and external ground fault sensing systems as noted on Drawings.

C. Electronic Trip Circuit Breakers

1. Circuit breaker trip system shall be a microprocessor-based true RMS sensing design with sensing accuracy through the thirteenth (13th) harmonic. Sensor ampere ratings shall be as indicated on Drawings.

2. The integral trip system shall be independent of any external power source and shall contain no less than industrial grade electronic components.

3. The ampere rating of the circuit breaker shall be determined by the combination of an interchangeable rating plug, the sensor size and the long-time pickup adjustment on the circuit breaker. The sensor size, rating plug and adjustment positions shall be clearly marked on the face of the circuit breaker. Circuit breakers shall be UL Listed to carry 80% (or 100% where noted on Drawings) of their ampere rating continuously.

4. The following time/current response adjustments shall be provided. Each adjustment shall have discrete settings and shall be independent of all other adjustments.

   a. Instantaneous Pickup

   b. Long Time Pickup

   c. Long Time Delay

   d. Short Time Pickup

   e. Short Time Delay

   f. Ground Fault Pickup (when specified with ground fault protection)

   g. Ground Fault Delay (when specified with ground fault protection)

5. A means to seal the trip unit adjustments in accordance with CEC/NEC 240-6(b) shall be provided.

6. Local visual trip indication for overload, short circuit and ground fault trip occurrences shall be provided.

7. An ammeter to individually display all phase currents flowing through the circuit breaker shall be provided. All current values shall be displayed in true RMS with 2% accuracy.

8. Long Time Pickup indication to signal when loading approaches or exceeds the adjusted ampere rating of the circuit breaker shall be provided.

9. The trip system shall include a Long Time memory circuit to sum the time increments of intermittent overcurrent conditions above the pickup point. Means shall be provided to reset Long Time memory circuit during primary injection testing.
10. An ammeter to individually display all phase currents flowing through the circuit breaker shall be provided. Indication of inherent ground fault current flowing in the system shall be provided on circuit breakers with integral ground fault protection. All current values shall be displayed in true RMS with 2% accuracy.
11. Circuit breakers shall be equipped with back-up thermal and magnetic trip system.
12. Equipment Ground Fault Protection shall be provided where noted on Drawings.
    a. Circuit breakers shall be provided with integral equipment ground fault protection for grounded systems. The circuit breaker shall be suitable for use on three-phase, three-wire circuits where the system neutral is grounded but not carried through the system or on three-phase, four-wire systems.
    b. A separate neutral current transformer shall be provided for three-phase, four-wire systems.
    c. Ground fault sensing system shall be residual sensing type.
    d. The trip system shall include a ground fault memory circuit to sum the time increments of intermittent ground faults above the pickup point.
    e. A means of testing the ground fault system to meet the on-site testing requirements of CEC/NEC 230-95(c) shall be provided.
    f. Local visual trip indication for a ground fault trip occurrence shall be provided.
    g. The ground fault sensing system shall be provided with Zone Selective Interlocking (ZSI) communication capabilities compatible with other thermal magnetic circuit breakers equipped with ground fault sensing, electronic trip circuit breakers with integral ground fault sensing and external ground fault sensing systems as noted on Drawings.
13. Circuit breaker trip system shall be equipped with an externally accessible test port. Disassembly of the circuit breaker shall not be required for testing. Test set shall be capable of verifying the operation of all trip functions with or without tripping the circuit breaker.

2.03 INSULATED CASE CIRCUIT BREAKERS

A. Circuit breaker trip system shall be a microprocessor-based true RMS sensing design with sensing accuracy through the thirteenth (13th) harmonic. Sensor ampere ratings shall be as indicated on Drawings.

B. The integral trip system shall be independent of any external power source and shall contain no less than industrial grade electronic components.

C. Circuit breakers shall be equipped with back-up thermal and magnetic trip system.

D. Circuit breakers shall have an RMS interrupting capacity not less than shown on Drawings, or if not shown shall not be less than:
    1. 100kA for all frame sizes at 208V

2. 65kA for all 800A - 2,000A frames at 480V
3. 100kA for all 3,000A - 4,000A frames at 480V

E. The ampere rating of the circuit breaker shall be determined by the combination of an interchangeable rating plug, the sensor size and the long-time pickup adjustment on the circuit breaker. The sensor size, rating plug and switch adjustments shall be clearly marked on the face of the circuit breaker. Circuit breakers shall be UL Listed to carry 100% of their ampere rating continuously.

F. The following time/current response adjustments shall be provided. Each adjustment shall have discrete settings and shall be independent from all other adjustments.

   a. Instantaneous Pickup
   b. Long Time Pickup
   c. Long Time Delay
   d. Short Time Pickup
   e. Short Time Delay
   f. Ground Fault Pickup (when specified with ground fault protection)
   g. Ground Fault Delay (when specified with ground fault protection)

G. Circuit breakers with adjustable short-time function shall be provided with defeatable instantaneous adjustment and 30 cycle short-time withstand ratings. Short-time withstand ratings shall be specified in RMS symmetrical amperes, as shown on the [drawings] [schedules].

H. A means to seal the rating plug and trip unit adjustments in accordance with CEC/NEC 240-6(b) shall be provided.

I. Local visual trip indication for overload, short circuit and ground fault trip occurrences shall be provided.

J. An ammeter to individually display all phase currents flowing through the circuit breaker shall be provided. [Indication of inherent ground fault current flowing in the system shall be provided on circuit breakers with integral ground fault protection]. All current values shall be displayed in True RMS with 2% accuracy.

K. Long Time Pickup indication to signal when loading approaches or exceeds the adjusted ampere rating of the circuit breaker shall be provided.

L. The trip system shall include a Long Time memory circuit to protect against intermittent overcurrent conditions above the long time pickup point. Means shall be provided to reset Long Time memory circuit during primary injection testing.

M. True two-step stored energy mechanism with five (5) cycle closing time shall be provided. All circuit breakers shall have multiple CHARGE/CLOSE provisions allowing the following sequence: CHARGE, CLOSE, RECHARGE, OPEN/CLOSE/OPEN

N. Local control pushbuttons to OPEN and CLOSE circuit breaker shall be provided. Color coded visual indication of contact position (OPEN or CLOSED) shall be provided on the face of the circuit breaker. Local manual charging following CLOSE operation shall be provided. Color coded visual indication of mechanism CHARGED and DISCHARGED position shall be provided on the face of the circuit breaker.

Visual indicator shall indicate CHARGED only when closing springs are completely charged.

O. Each circuit breaker shall be electrically operated to permit remote CHARGE, CLOSE, and OPEN capabilities. Electrically operated circuit breaker shall be equipped with charge contact switch for remote indication of mechanism charge status.

P. An ammeter to individually display all phase currents flowing through the circuit breaker shall be provided. [Indication of inherent ground fault current flowing in the system shall be provided on circuit breakers with integral ground fault protection]. All current values shall be displayed in True RMS with 2% accuracy.

Q. All circuit breakers shall be equipped with electrical accessories as noted on Drawings.

R. Provide the following interlocking capabilities:

1. cell door interlock
2. key interlock for main-tie-main
3. lock off

S. Circuit breaker trip system shall be equipped with an externally accessible test port. Disassembly of the circuit breaker shall not be required for testing. Test set shall be capable of verifying the operation of all trip functions with or without tripping the circuit breaker.

T. Equipment Ground Fault Protection shall be provided where noted on Drawings.

1. Circuit breakers shall be provided with integral equipment ground fault protection for grounded systems. The circuit breaker shall be suitable for use on three-phase, three-wire circuits where the system neutral is grounded but not carried through the system or on three-phase, four-wire systems.
2. A separate neutral current transformer shall be provided for three-phase, four-wire systems.
3. Ground fault sensing system shall be residual sensing type.
4. The trip system shall include a ground fault memory circuit to sum the time increments of intermittent ground faults above the pickup point.
5. A means of testing the ground fault system to meet the on-site testing requirements of CEC/NEC 230-95(c) shall be provided.
6. Local visual trip indication for a ground fault trip occurrence shall be provided.
7. The ground fault sensing system shall be provided with Zone Selective Interlocking (ZSI) communication capabilities compatible with other thermal magnetic circuit breakers equipped with ground fault sensing, electronic trip circuit breakers with integral ground fault sensing and external ground fault sensing systems as noted on Drawings.

2.04 DRAWOUT INSULATED CASE CIRCUIT BREAKERS

A. Main circuit breaker shall meet the same requirements of insulated case circuit breakers and be individually drawout mounted where shown on Drawings.

B. Sturdy drawout rails shall be permanently attached to the sides of the breaker compartment and retract into the compartment when not in use.

C. When fully withdrawn, the circuit breaker shall permit access for inspection and testing. Circuit breaker(s) shall also be removable from the rails completely.

D. When the circuit breaker is in the Connected, Test, or Disconnected positions, or when the circuit breaker is removed from the compartment, the compartment door shall be able to be fully closed and secured.

E. A removable crank shall be supplied for racking the circuit breaker between the Connected, Test, or Disconnected positions.

PART 3 - EXECUTION

3.01 PREPARATION

A. Notify Engineer no later than 10 working days for adjustable circuit breaker settings not shown within Drawings. Submit to Engineer the following information:

1. Panel, switchboard name/ID
2. Circuit breaker identifier (i.e., main circuit breaker, load served, etc.)
3. List of necessary settings (i.e., trip settings, time delays, etc.)

3.02 INSTALLATION

A. Install equipment and their accessories in to manufacturer's instructions, pertinent Codes, and with recognized industry practices to insure device operates properly.

B. Tighten electrical connectors and terminals in accordance to manufacturer's requirements. Where the manufacturer does not have published torque tightening values, comply with the requirements of UL 468.

3.03 FIELD QUALITY CONTROL

A. Check tightness of circuit breaker connections using a calibrated torque wrench or torque screwdriver per manufacturer's written specifications.

B. Obtain the services of an independent testing company who shall provide quality control and adjustments as well as tests for

1. Check each circuit breaker above 100A on a 225A frame for long-time and short-time delay pickup and instantaneous pickup.
    a. Instantaneous pickup current shall be determined by 4 cycles or less.
    b. Perform timing test with 300% of breaker trip unit rated current.
    c. Adjust unit if required, so that the tripping characteristics are within the limits of the published time-current characteristic curves for that particular trip unit.
2. Test and calibrate ground fault protection trip and pickup time on 225A frame breakers and larger.

C. Physically test key interlock systems to check for proper functionality.

D. Check and set where required all protective device settings in accordance with approved coordination study settings and conduct ground fault acceptance tests.

3.04 ADJUSTING

A. Adjust all operating mechanisms for free mechanical movement per manufacturer's specifications.

B. Adjust circuit breaker trip and time delay settings to values indicated as instructed by Engineer.

1. Check each circuit breaker above 100A, long-time and short-time delay pickup and instantaneous pickup. Instantaneous pickup current shall be determined by 4 cycles or less. Perform timing test with 300% of breaker trip unit rated current. Adjust unit if required, so that the tripping characteristics are within the limits of the published time-current characteristic curves for that particular trip unit.

2. Main circuit breaker ground fault setting shall be per CEC/NEC 230-95(a) or as directed by Engineer.

3.05 PROTECTION

A. When directed by Engineer provide physical means to "permanently fix" settings for rotary and DIP type switches with a thin coat of clear lacquer.

3.06 CLEANING

A. Remove marks, dirt and debris from installed equipment surfaces for "new like" appearance.

END OF SECTION

SECTION 26 28 16 – SAFETY SWITCHES AND INDIVIDUAL MOUNTED CIRCUIT BREAKERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes

1. Provide all labor, materials and equipment necessary to complete the installation required for the items specified under this Section, including but not limited to heavy duty fusible, non-fusible and double throw safety switches.

B. Related sections

1. Where items specified in other Division 26 sections conflict with the requirements of this Section, the most stringent requirement shall govern.
    a. 26 05 26 – Grounding and Bonding for Electrical Systems
    b. 26 28 11 – Overcurrent Protection Devices
2. The requirements of this Section apply to all Division 26 work, as applicable.
3. Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified:

1. CCR –California Code of Regulations, Title 24
    a. Part 3 -California Electrical Code(CEC); NFPA 70 National Electrical Code (NEC) with California amendments
2. NEMA –National Electrical Manufacturer’s Association
    a. KS 1; Enclosed Switches
    b. 250; Enclosures for Electrical Equipment
3. UL -Underwriters Laboratories, Inc.
    a. 98; Enclosed and Dead Front Switches
    b. 489; Molded-Case Circuit Breakers and Circuit Breaker Enclosures

1.03 SUBMITTALS

A. Submit manufacturer’s data for materials specified within this Section in accordance to Section 26 05 00.

1.04 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the materials specified herein shall be new and unused, bearing UL labels where applicable.

1.05 DELIVERY, STORAGE AND HANDLING

A. Handle carefully to avoid damage to internal components, enclosure and finish.

B. Store in a clean, dry environment. Maintain factory packaging and, if required, provide an additional cover to protect enclosure in harsh environments.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Square D, Cutler Hammer or approved equal.

2.02 MATERIALS

A. Heavy-duty safety switches

1. Switch interior

a. All switches shall have switch blades which are visible when the switch is OFF and the cover is open.

b. Lugs shall be front removable and UL Listed for 75°C conductors, aluminum or copper.

c. 30A through 100A switches shall be equipped with factory or field installed fuse pullers.

d. Switches required for Type 12, 12K or Type 4-4X-5 stainless steel applications shall have all copper current carrying parts.

e. All current carrying parts shall be plated to resist corrosion.

f. Switches shall have removable arc suppressors to facilitate easy access to line side lugs.

g. Switches shall have provisions for a field installable electrical interlock.

2. Switch mechanism

a. Switch operating mechanism shall be quick-make, quick-break such that, during normal operation of the switch, the operation of the contacts shall not be capable of being restrained by the operating handle after the closing or opening action of the contacts has started.

b. The operating handle shall be an integral part of the box, not the cover.

c. Provisions for padlocking the switch in the OFF position with at least three padlocks shall be provided.

d. The handle position shall travel at least 90° between OFF and ON positions to clearly distinguish and indicate handle.

e. All switches shall have a dual cover interlock mechanism to prevent unintentional opening of the switch cover when the switch is ON and prevent turning the switch ON when the cover is open. The cover interlock mechanism shall have an externally operated override but the override shall not permanently disable the interlock mechanism. The tool used to override

the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.

3. Switch enclosures
   a. All enclosures shall be NEMA 1 general purpose unless otherwise noted.
   b. Switch covers shall be attached:
      1) with welded pin-type hinges (Type 1, 12, 12K, 4-4X-5 stainless steel).
      2) top hinged, attached with removable screws and securable in the open position (Type 3R).
      3) by molded hinges and type 316 stainless steel hinge pins (Type 4X polyester).
      4) by type 316 stainless steel bolts (Type 7/9).
   c. The enclosure shall be finished with:
      1) gray baked enamel paint which is electrodeposited on cleaned, phosphate pre-treated steel (Type 1).
      2) gray baked enamel paint which is electrodeposited on cleaned, phosphate pre-treated galvannealed steel (Type 3R, 12, 12K).
      3) a brush finish on type 304 stainless steel (Type 4-4X-5 stainless steel).
      4) Gray baked enamel on copper free cast aluminum alloy (Type 7/9).
   d. The enclosure shall have ON and OFF markings:
      1) stamped into the cover (Type 1, 3R, 4-4X-5 stainless steel, 12, 12K).
      2) cast into the cover (Type 7/9).
      3) inked on a adhesive label (Type 4X polyester).
   e. The operating handle shall be provided with a dual colored, red/black position indication.
   f. All switches shall have provisions to accept up to three 3/8” hasp padlocks to lock the operating handle in the OFF position.
4. Switch ratings
   a. Switches shall be horsepower rated for ac and/or dc as indicated on Drawings.
   b. The UL Listed short circuit current rating of the switches shall be:
      1) 10,000 rms symmetrical amperes when used with or protected by Class H or K fuses (30-600A).
      2) 200,000 rms symmetrical amperes when used with or protected by Class R or Class J fuses (30-600A switches employing appropriate fuse rejection schemes).
      3) 200,000 rms symmetrical amperes when used with or protected by Class L fuses (800-1200A)

B. Double throw switches

1. Shall have the same characteristics as heavy-duty safety switches above for switch interior, mechanism, enclosure and rating.
2. Additional switch operating mechanism characteristics shall be:
   a. quick-make, quick-break for 60A through 200A, 2 pole and 3 pole devices.
   b. Slow-make, slow-break for
      1) 30A and greater than 200A, 2 pole and 3 pole devices.
      2) 60A through 200A, 4 pole devices.

C. Individual Mounted Circuit Breakers

1. Circuit Breaker
   a. Circuit breakers shall be of type, rating and poles shown on Drawings per Section 26 28 11 – Overcurrent Protection Devices.
2. Enclosure
   a. Enclosure shall be galvanized steel constructed in accordance with UL 50 requirements, and be NEMA 1, unless specifically shown or specified otherwise.

PART 3 - EXECUTION

3.01 INSTALLATION

A. The equipment shall be installed per the manufacturer's recommendations.

B. Anchor safety switches to structural members and as shown on Drawings. Provide additional support as required.

C. Mount safety switches level and plumb.

3.02 FIELD QUALITY CONTROL

A. Inspect complete installation prior to energizing for physical damage, proper alignment, anchorage and grounding.

B. Check tightness of bolted connections per manufacturer’s written specifications.

END OF SECTION

SECTION 26 32 13

ENGINE GENERATOR

PART 1 — GENERAL

1.01 SUMMARY

A. Section includes

1. Provide all labor, materials and equipment necessary to complete the installation required for the items specified under this Section, including but not limited to engine generators, its accessories and controls.

B. Related work under this section

1. Where items specified in other Division 26 sections conflict with the requirements of this Section, the most stringent requirement shall govern.
    a. 26 05 26 – Grounding and Bonding for Electrical Systems
    b. 26 18 11 – Overcurrent Protection Devices
2. The requirements of this Section apply to all Division 26 work, as applicable.
3. Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.

1.02 REFERENCES

A. The generator set and its installation and on-site testing shall conform to the requirements of the following codes and standards:

1. CCR –California Code of Regulations, Title 24
    a. Part 3 -California Electrical Code(CEC); NFPA 70 National Electrical Code (NEC) with California amendments
    b. Part 9 -California Fire Code; WFCA Uniform Fire Code (UFC) with California amendments
2. FCC Part 15, Subpart B.
3. ISO –International Organization for Standardization
    a. 8528; Reciprocating Internal Combustion Engine Driven Alternating Current Generating Sets (All Parts)
4. IEEE –Institute of Electrical and Electronic Engineers
    a. C2; National Electrical Safety Code (NESC)
    b. 446; Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications
5. NECA –National Electrical Contractors Association
    a. 404; Recommended Practice for Installing Generator Sets

6. NEMA –National Electrical Manufacturer's Association
   a. ICS 1; Industrial Control and Systems: General Requirements
   b. MG 1; Motors and Generators
   c. MG 2; Safety Standard for Construction and Guide for Selection, Installation, and Use of Electric Motors and Generators
7. NFPA –National Fire Protection Association
   a. 37; Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines
   b. 99; Standard for Health Care Facilities
   c. 110; Standard for Emergency and Standby Power Systems
8. UL -Underwriters Laboratories, Inc.
   a. 508; Standard for Industrial Control Equipment
   b. 2085; Standard for Protected Aboveground Tanks for Flammable and Combustible Liquids
   c. 2200; Standard for Stationary Engine Generator Assemblies

1.03 SYSTEM DESCRIPTION

A. Provide a standby power system to supply electrical power at 120/240Volts,60 Hertz, 3 Phase, 4 Wire. The generator shall consist of a liquid cooled diesel engine, a synchronous AC alternator, and system controls with all necessary accessories for a complete operating system, including but not limited to the items as specified hereinafter.

B. The stand-by generator set shall be supplied to operate on No. 2 diesel fuel. The engine shall be liquid cooled by means of engine mounted radiator.

C. The stand-by generator set shall be rated continuous stand-by (defined continuous for the duration of any power outage) per Part 2 below.

D. Engine: The turbo charged engine shall be diesel fueled, 4 cycle, liquid cooled, with a governed speed of 1800 RPM. Engine shall be turbocharged with intercooler/aftercooler, forged steel crankshaft and rods. Engine shall be equipped with 90% efficient controls for crankcase emissions, in full conformance with the latest and applicable California Air Resources requirements and all local emissions requirements. Submit certifications with the submittals.

1.04 SUBMITTALS

A. Submit manufacturer's data for materials specified within this Section in accordance to Section 26 05 00.

B. The submittal shall contain the following minimum information:
   1. Engine Generator specification sheet
   2. Controls specification sheet(s)
   3. Installation / Layout dimensional drawing

4. Wiring schematic
5. Sound data
6. Emission certification
7. Warranty statement

C. Manufacturer shall assist Owner in acquiring all necessary CARB installation and initial operation permits for the gen-set.

1.05 QUALITY ASSURANCE

A. Installation shall conform to NECA 404, Recommended Practice for Installing Generator Sets unless otherwise specified.

B. The engine shall be equipped with all devices and accessories required to meet the California Air Resources Board and other applicable State and Local emissions standards.

1.06 DELIVERY, STORAGE AND HANDLING

A. Handle carefully to avoid damage to internal components, enclosure and finish.

B. Store in a clean, dry environment. Maintain factory packaging and, if required, provide an additional cover to protect enclosure in harsh environments.

1.07 WARRANTY

A. Furnish one-year guarantee in accordance with and in form required under Section 26 05 00.

B. The generator set and associated equipment shall be warranted for a period of not less than 5 years from the date of commissioning against defects in materials and workmanship.

C. Service and support

1. The manufacturer of the generator set shall maintain service parts inventory at a central location which is accessible to the service location 24 hours per day, 365 days per year.
2. The generator set shall be serviced by a local service organization that is trained and factory certified in generator set service. The supplier shall maintain an inventory of critical replacement parts at the local service organization, and in service vehicles. The service organization shall be on call 24 hours per day, 365 days per year.
3. The manufacturer shall maintain model and serial number records of each generator set provided for at least 20 years.

1.08 SYSTEM STARTUP

A. Refer to manufacturer’s documentation to start-up procedures and requirements.

PART 2 — PRODUCTS

2.01 MANUFACTURER

A. All equipment shall be new and of current production of a National firm, who manufactures the generator, engine, control panel, acoustical assemblies comprising the stand-by generator set as a matched unit, having a service and parts organization.

B. Manufacturer: Cummins, Kohler, or approved equal.

C. General

1. Basis of design is Kohler 150REOZJF with Level 2 Sound Housing.
2. Ratings based on site conditions of : Altitude 1900 ft. ambient temperatures up to 105ºF
3. The generator set rating shall be based on emergency/standby service.
4. The generator set shall operate at 1800 RPM and at a voltage of: 120/24Vac, 3 phase, Four-wire, 60 Hz.
5. The generator set shall be stand-by rated at 150kW, 187.5kVA, 412A at 0.8 PF.
6. The alternator shall support the following site requirements:
   a. Running : 144kW/170kVA
   b. Max Starting: 433kW/530kVA
   c. Maximum voltage drop of 20% and frequency dip of 10%.

2.02 ENGINE

A. Engine Rating and Performance

1. The prime mover shall be a liquid cooled, diesel fueled, turbocharged after-cooled engine of 4-cycle design. It will have adequate horsepower to achieve rated kW output with at an operating speed of 1800 RPM.
2. The engine shall support a 100% load step.
3. The generator system shall support generator start-up and load transfer within 10 seconds.

B. Engine Oil System

1. Full pressure lubrication shall be supplied by a positive displacement lube oil pump. The engine shall have a replaceable oil filter(s) with internal bypass and replaceable element(s).
2. The engine shall operate on mineral based oil. Synthetic oils shall not be required.
3. The oil shall be cooled by an oil cooler which is integrated into the engine system.

C. Engine Cooling System

1. The engine is to be cooled with a unit mounted radiator, fan, water pump, and closed coolant recovery system. The coolant system shall include a coolant fill box which will provide visual means to determine if the system has adequate coolant level. The radiator shall be designed for operation in 122 degrees F, (50 degrees C) ambient temperature.
2. The engine shall have (a) unit mounted, thermostatically controlled water jacket heater(s) to aid in quick starting. The wattage shall be as recommended by the manufacturer.
3. Engine coolant and oil drain extensions, equipped with pipe plugs and shut-off valves, must be provided to the outside of the mounting base for cleaner and more convenient engine servicing.
4. A radiator fan guard must be installed for personnel safety that meets UL and OSHA safety requirements.

D. Engine Starting System

1. Starting shall be by a solenoid shift, DC starting system.
2. The engine's cranking batteries shall be lead acid. The batteries shall be sized per the manufacturer's recommendations. The batteries supplied shall meet NFPA 110 cranking requirements of 90 seconds of total crank time. Battery specifications (type, amp-hour rating, cold cranking amps) to be provided in the submittal.
3. The genset shall have an engine driven, battery charging alternator with integrated voltage regulation.
4. The genset shall have an automatic dual rate, float equalize, 10 amp battery charger. The charger must be protected against a reverse polarity connection. The chargers charging current shall be monitored within the generator controller to support remote monitoring and diagnostics. The battery charger is to be factory installed on the generator set. Due to line voltage drop concerns, a battery charger mounted in the transfer switch will be unacceptable.

E. Engine Fuel System

1. The engine fuel system shall be designed for operation on #2 diesel fuel and cold weather diesel blends.
2. The engine shall include a primary fuel filter, water separator, manual fuel priming pump, and engine flexible fuel lines must be installed at the point of manufacture. Element shall be replaceable paper type.
3. The engines suction line shall be fitted with a check valve to secure prime for the engines injection pump.

F. Engine Controls

1. Engines that are equipped with an electronic engine control module (ECM), shall monitor and control engine functionality and seamlessly integrate with the genset controller through digital communications. ECM monitored parameters shall be integrated into the genset controllers NFPA 110 alarm and warning requirements. All ECM fault codes shall be displayed at the genset controller in standard language - fault code numbers are not acceptable.

2. For engines without ECM functionality or for any additional genset controller monitoring, sensors are to be conditioned to a 4-20ma signal level to enhance noise immunity and all sensor connections shall be sealed to prevent corrosion.
3. Engine speed shall be controlled with an integrated isochronous governor function with no change in alternator frequency from no load to full load. Steady state regulation is to be 0.25%.

G. Engine Exhaust & Intake

1. The engine exhaust emissions shall meet the EPA emission requirements for standby power generation.
2. The manufacturer shall supply its recommended stainless steel, flexible connector to couple the engine exhaust manifold to the exhaust system. A rain cap will terminate the exhaust pipe after the silencer. All components must be properly sized to assure operation without excessive back pressure when installed.
3. The manufacturer shall supply a critical grade exhaust silencer as standard. For applications with site specific sound requirements (reference section 1.1), the silencer shall be selected to achieve site sound levels.
4. For gensets in a weather or sound attenuated enclosure, all exhaust piping from the turbo-charger discharge to the silencer shall be thermally wrapped to minimize heat dissipation inside the enclosure.
5. The engine intake air is to be filtered with engine mounted, replaceable, dry element filters.

2.03 ALTERNATOR

A. The alternator shall be the voltage and phase configuration as specified in this Section.

B. The alternator shall be a 4 pole, revolving field, stationary armature, synchronous machine. The excitation system shall utilize a brushless exciter with a three phase full wave rectifier assembly protected against abnormal transient conditions by a surge protector. Photo-sensitive components will not be permitted in the rotating exciter.

C. The alternator shall include a permanent magnet generator (PMG) for excitation support. The system shall supply a minimum short circuit support current of 300% of the rating (250% for 50Hz operation) for 10 seconds.

D. Three phase alternators shall be 12 lead, broad range capable of supporting voltage reconnection. Single phase alternators shall be four lead and dedicated voltage designs (600v) shall be six lead. All leads must be extended into a NEMA 1 connection box for easy termination. A fully rated, isolated neutral connection must be included by the generator set manufacturer.

E. The alternator shall use a single, sealed bearing design. The rotor shall be connected to the engine flywheel using flexible drive disks. The stator shall be direct connected to the engine to ensure permanent alignment.

F. The alternator shall meet temperature rise standards of UL2200 (120 degrees C). The insulation system material shall be class "H" capable of withstanding 125 degrees C temperature rise.

G. The alternator shall be protected against overloads and short circuit conditions by advanced control panel protective functions. The control panel is to provide a time current algorithm that protects the alternator against short circuits. To ensure precision protection and repeatable trip characteristics, these functions must be implemented electronically in the generator control panel -- thermal magnetic breaker implementation are not acceptable.

H. An alternator strip heater shall be installed to prevent moisture condensation from forming on the alternator windings. A tropical coating shall also be applied to the alternator windings to provide additional protection against the entrance of moisture.

2.04 CONTROLS

A. The generator control system shall be a fully integrated microprocessor based control system for standby emergency engine generators meeting all requirements of NFPA 110 level 1.

B. The generator control system shall be a fully integrated control system enabling remote diagnostics and easy building management integration of all generator functions. The generator controller shall provide integrated and digital control over all generator functions including: engine protection, alternator protection, speed governing, voltage regulation and all related generator operations. The generator controller must also provide seamless digital integration with the engine's electronic engine control module (ECM) if so equipped. Generator controller's that utilize separate voltage regulators and speed governors or do not provide seamless integration with the engine management system are considered less desirable.

C. Communications shall be supported with building automation via the Modbus protocol without network cards. Optional internet and intranet connectivity shall be available.

D. The control system shall provide an environmentally sealed design including encapsulated circuit boards and sealed automotive style plugs for all sensors and circuit board connections. The use of non-encapsulated boards, edge cards, and pc ribbon cable connections are considered unacceptable.

E. Circuit boards shall utilize surface mount technology to provide vibration durability. Circuit boards that utilize large capacitors or heat sinks must utilize encapsulation methods to securely support these components.

F. A predictive maintenance algorithm that alarms when maintenance is required. The controller shall have the capability to call out to the local servicing dealer when maintenance is required.

G. Diagnostic capabilities should include time-stamped event and alarm logs, ability to capture operational parameters during events, simultaneous monitoring of all input or output parameters, callout capabilities, support for multi-channel digital strip chart functionality and .2 msec data logging capabilities.

H. In addition to standard NFPA 110 alarms, the application loads should also be protected through instantaneous and steady state protective settings on system voltage, frequency, and power levels.

I. The control system shall provide pre-wired customer use I/O: 4 relay outputs (user definable functions), communications support via RS232, RS485, or an optional modem. Additional I/O must be an available option.

J. Customer I/O shall be software configurable providing full access to all alarm, event, data logging, and shutdown functionality. In addition, custom ladder logic functionality inside the generator controller shall be supported to provide application support flexibility. The ladder logic function shall have access to all the controller inputs and customer assignable outputs.

K. The control panel will display all user pertinent unit parameters including: engine and alternator operating conditions; oil pressure and optional oil temperature; coolant temperature and level alarm; fuel level (where applicable); engine speed; DC battery voltage; run time hours; generator voltages, amps, frequency, kilowatts, and power factor; alarm status and current alarm(s) condition per NFPA 110 level 1.

2.05 ENGINE / ALTERNATOR PACKAGING

A. The engine/alternator shall be isolated from the generator frame with rubber isolators. The packaging shall not require the addition of external spring isolators.

B. A mainline, thermal magnetic circuit breaker carrying the UL mark shall be factory installed. The breaker shall be rated between 100 to 125% of the rated ampacity of the genset. The line side connections are to be made at the factory. Output lugs shall be provided for load side connections.

C. A second mainline, thermal magnetic circuit breaker carrying the UL mark shall be factory installed. The line side connections are to be made at the factory. Output lugs shall be provided for load side connections.

D. The generator shall include a unit mounted 120 volt convenience outlet.

E. Enclosure

1. The genset shall be packaged with a sound attenuating enclosure with a maximum rating of 76dBA at any location 23 feet from the generator set in a free field environment.

2. The enclosure shall be completely lined with sound deadening material. This material must be of a self-extinguishing design.

3. The enclosure shall be made of steel with a minimum thickness of 14 gauge. The enclosure is to have hinged, removable doors to allow access to the engine, alternator and control panel. The hinges shall allow for door fit adjustment. Hinges and all exposed fasteners will be stainless steel or JS5000. The use of pop-rivets weakens the paint system and not allowed on external painted surfaces. Key-locking and pad-lockable door latches shall be provided for all doors.

4. The enclosure shall be coated with electrostatic applied powder paint, baked and finished to manufacturer's specifications. The color will be manufacturer's standard.

5. The enclosure shall utilize an upward discharging radiator hood. Due to concerns relative to radiator damage, circulating exhaust, and prevailing winds, equipment without a radiator discharge hood will not be acceptable.

6. The genset silencer shall be mounted on the discharge hood of the enclosure. Due to architectural concerns, silencers mounted on the top of the generator enclosure are not acceptable. Gensets with silencers mounted inside the main generator compartment are acceptable only if the silencer is thermally wrapped to minimize heat stress on the surrounding components.

F. Base:

1. The engine-generator set shall be mounted with vibration isolators Caldyn or equal, on a heavy duty steel base to maintain proper alignment between components. The engine-generator set shall incorporate a battery tray with battery hold-down clamps within the base rails.

G. Sub-base fuel tank

1. The packaging shall include a double wall, sub-base mounted, UL142 listed fuel tank. The tank shall be sized to provide 24 hours of run time.
2. The tank shall include fuel suction and return connections, normal and emergency vents, secondary containment emergency vent and rupture basin sensor, mechanical fuel level indication and a stub-up area convenient for electrical conduit entry.
3. The fuel tank shall use an electric fuel sensor to provide an analog indication of fuel level. The controller shall have a warning indication on low fuel level and provide optional shutdown functionality for low, low fuel level.
4. The fuel tank shall have a sloped top and bottom. The sloped top allows water to run off. The sloped bottom allows the water and other impurities in the fuel to collect near the back of the tank away from the fuel suction point.
5. The fuel tank must be supplied by the engine-generator set manufacturer and be installed before shipment.

2.06 LOOSE ITEMS

A. Supplier to itemize loose parts that require site mounting and installation. Preference will be shown for gensets that factory mount items like mufflers, battery chargers, etc.

B. Spare Parts:

1. Fuses: One spare set
2. Filters One spare set (air, fuel, oil)

PART 3 - EXECUTION

3.01 INSTALLATION

A. Equipment shall be installed by the contractor in accordance with final submittals and Drawings. Installation shall comply with applicable state and local codes as required by the authority having jurisdiction. Install equipment in accordance with manufacturer's instructions and instructions included in the listing or labeling of UL listed products.

B. Installation of equipment shall include furnishing and installing all interconnecting wiring between all major equipment provided for the on-site power system. The contractor shall also perform interconnecting wiring between equipment sections (when required), under the supervision of the equipment supplier. Provide flexible electrical connections from pad to equipment.

C. Equipment shall be installed on concrete housekeeping pads. Equipment shall be permanently fastened to the pad in accordance with manufacturer's instructions and seismic requirements of the site.

D. Equipment shall be initially started and operated by representatives of the manufacturer.

E. All equipment shall be physically inspected for damage. Scratches and other installation damage shall be repaired prior to final system testing. Equipment shall be thoroughly cleaned to remove all dirt and construction debris prior to initial operation and final testing of the system.

3.02 STARTUP AND COMMISSIONING

A. The supplier of the electric generating plant and associated items covered herein shall provide factory trained technicians to checkout the completed installation and to perform an initial startup inspection to include:

1. Ensuring the engine starts (both hot and cold) within the specified time.
2. Verification of engine parameters within specification.
3. Verify no load frequency and voltage, adjusting if required.
4. Test all automatic shutdowns of the engine-generator.
5. Perform a load test of the electric plant, ensuring full load frequency and voltage are within specification by using building load.

B. Provide documentation of the above tests in accordance to NFPA 110.

3.03 TESTING

A. The complete installation shall be tested for compliance with the specification following completion of all site work. Testing shall be conducted by representatives of the manufacturer, with required fuel supplied by Contractor. The Engineer shall be notified in advance and shall have the option to witness the tests.

B. Installation acceptance tests to be conducted on-site shall include a "cold start" test, a two hour full load test, and a one step rated load pickup test in accordance with NFPA 110. Provide a resistive load bank and make temporary connections for full load test.

C. Perform a power failure test on the entire installed system. This test shall be conducted by opening the power supply from the utility service, and observing proper operation of the system for at least 2 hours. Coordinate timing and obtain approval for start of test with site personnel.

D. After installation, the Contractor shall demonstrate to the Owner and the Local Fire Authority that the fuel system is complete, without leaks and is seismically braced.

3.04 TRAINING

A. Training is to be supplied by the start-up technician during commissioning. The training should cover basic generator operation and common generator issues that can be managed by the end-user.

B. Training is to include manual operation of system.

END OF SECTION

SECTION 26 36 00 - AUTOMATIC TRANSFER & BYPASS-ISOLATION SWITCH

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes

1. Provide all labor, materials and equipment necessary to complete the installation required for the items specified under this Section, including but not limited to automatic transfer switches (ATS) or automatic transfer switch with by-pass switch (ATS/BPS).

B. Related sections

1. Where items specified in other Division 26 sections conflict with the requirements of this Section, the most stringent requirement shall govern.
    a. 26 05 26 – Grounding and Bonding for Electrical Systems
2. The requirements of this Section apply to all Division 26 work, as applicable.
3. Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified:

1. CCR –California Code of Regulations, Title 24
    a. Part 3 -California Electrical Code(CEC); NFPA 70 National Electrical Code (NEC) with California amendments
2. NEMA –National Electrical Manufacturer’s Association
    a. ICS10-1993 (formerly ICS2-447) -AC Automatic Transfer Switches
3. NFPA –Nation Fire Protection Association
    a. NFPA 99 -Essential Electrical Systems for Health Care Facilities
    b. NFPA 110 -Emergency and Standby Power Systems
4. UL -Underwriters Laboratories, Inc.
    a. UL 508 Industrial Control Equipment
    b. UL 1008 -Standard for Transfer Switch Equipment

1.03 SUBMITTALS

A. Submit manufacturer’s data for materials specified within this Section in accordance to Section 26 05 00.

B. Shop Drawings shall indicate front and side enclosure elevations with overall dimensions shown; conduit entrance locations and requirements; nameplate legends; one-line diagrams; equipment schedule; and instrument details.

1.04 QUALITY ASSURANCE

A. The complete assembly shall be factory tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure that the operating transfer time, voltage, frequency and time delay settings are in compliance with the specification requirements.

B. Upon request, the manufacturer shall provide a notarized letter certifying compliance with all of the requirements of this specification including compliance with the above codes and standards, and withstand and closing ratings. The certification shall identify, by serial number(s), the equipment involved. No exceptions to the specifications, other than those stipulated at the time of the submittal, shall be included in the certification.

C. The manufacturer shall be certified to ISO 9001 International Quality Standard and the manufacturer shall have third party certification verifying quality assurance in design/development, production, installation, and servicing in accordance with ISO 9001.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect, and handle products in conformance with manufacturer's recommended practices as outlined in applicable Installation and Maintenance Manuals.

B. Store in a clean, dry space. Maintain factory protection and/or provide an additional heavy canvas or heavy plastic cover to protect structure from dirt, water, construction debris, and traffic. Where applicable, provide adequate heating within enclosures to prevent condensation.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Emerson Power/ASCO Series 7000 or approved equal.

2.02 EQUIPMENT

A. Mechanically Held Transfer Switch

1. The transfer switch shall be electrically operated and mechanically held. The electrical operator shall be a momentarily energized, single-solenoid mechanism. Main operators which include overcurrent disconnect devices, linear motors or gears shall not be acceptable. The switch shall be mechanically interlocked to ensure only two possible positions, normal or emergency.

2. All transfer switch sizes shall use only one type of main operator for ease of maintenance and commonality of parts.

3. The switch shall be positively locked and unaffected by momentary outages, so that contact pressure is maintained at a constant value and contact temperature rise is minimized for maximum reliability and operating life.

4. All main contacts shall be silver composition. Switches rated 600 amperes and above shall have segmented, blow-on construction for high withstand and close-on capability and be protected by separate arcing contacts.

5. Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. Switches rated 600 amps and higher shall have front removable and replaceable contacts. All stationary and moveable contacts shall be replaceable without removing power conductors and/or bus bars.
6. Designs utilizing components of molded-case circuit breakers, contactors, or parts thereof, which are not intended for continuous duty, repetitive switching or transfers between two active power sources are not acceptable.
7. Where neutral conductors must be switched as shown on the plans, the AS shall be provided with fully rated overlapping neutral transfer contacts. The neutrals of the normal and emergency power sources shall be connected together only during the transfer and retransfer operation and remain connected together until power source contacts close on the source to which the transfer is being made. The overlapping neutral contacts shall not overlap for a period greater than 100 milliseconds. Neutral switching contacts that do not overlap are not acceptable.
8. Where neutral conductors are to be solidly connected as shown on the plans, a neutral conductor plate with fully rated AL-CU pressure connectors shall be provided.

B. Bypass-Isolation Switch (only as noted on Drawings)

1. A two-way bypass-isolation switch shall provide manual bypass of the load to either source and permit isolation of the automatic transfer switch from all source and load power conductors. All main contacts shall be manually driven.
2. Power interconnections shall be silver-plated copper bus bar. The only field installed power connections shall be at the service and load terminals of the bypass-isolation switch. All control interwiring shall be provided with disconnect plugs.
3. Separate bypass and isolation handles shall be utilized to provide clear distinction between the functions. Handles shall be permanently affixed and operable without opening the enclosure door. Designs requiring insertion of loose operating handles or opening of the enclosure door to operate are not acceptable.
4. Bypass to the load-carrying source shall be accomplished with no interruption of power to the load (make before break contacts). Designs that disconnect the load when bypassing are not acceptable. The bypass handle shall have three operating modes: "Bypass to Normal," "Automatic," and "Bypass to Emergency." The operating speed of the bypass contacts shall be the same as the associated transfer switch and shall be independent of the speed at which the manual handle is operated. In the "Automatic" mode, the bypass contacts shall be out of the power circuit so that they will not be subjected to fault currents to which the system may be subjected.
5. The isolation handle shall provide three operating modes: "Closed," "Test," and "Open." The "Test" mode shall permit testing of the entire emergency power system, including the automatic transfer switches with no interruption of power to the load. The "Open" mode shall completely isolate the automatic transfer switch from all source and load power conductors. When in the "Open" mode, it shall be possible to completely withdraw the automatic transfer switch for inspection or

maintenance to conform to code requirements without removal of power conductors or the use of any tools.

6. When the isolation switch is in the "Test" or "Open" mode, the bypass switch shall function as a manual transfer switch.
7. Designs requiring operation of key interlocks for bypass isolation or ATS's that cannot be completely withdrawn when isolated are not acceptable.

C. Microprocessor Controller

1. The controller's sensing and logic shall be provided by a single built-in microprocessor for maximum reliability, minimum maintenance, and the ability to communicate serially through an optional serial communication module.
2. A single controller shall provide twelve selectable nominal voltages for maximum application flexibility and minimal spare part requirements. Voltage sensing shall be true RMS type and shall be accurate to ± 1% of nominal voltage. Frequency sensing shall be accurate to ± 0.2%. The panel shall be capable of operating over a temperature range of -20 to +60°C and storage from -55 to +85°C.
3. The controller shall be connected to the transfer switch by an interconnecting wiring harness. The harness shall include a keyed disconnect plug to enable the controller to be disconnected from the transfer switch for routine maintenance. Sensing and control logic shall be provided on multi-layer printed circuit boards. Interfacing relays shall be industrial grade plug-in type with dust covers. The panel shall be enclosed with a protective cover and be mounted separately from the transfer switch unit for safety and ease of maintenance. The protective cover shall include a built-in pocket for storage of the operator's manuals.
4. All customer connections shall be wired to a common terminal block to simplify field-wiring connections.
5. The controller shall meet or exceed the requirements for Electromagnetic Compatibility (EMC) as follows:
   a. IEEE472 (ANSI C37.90A) Ring Wave Test.
   b. ENC55011 1991 Class A Conducted and Radiated Emission.
   c. EN61000-4-2 Electrostatic Discharge Immunity, Direct Contact & Air Discharge.
   d. EN61000-4-3 Radiated Electromagnetic Field Immunity.
   e. EN61000-4-4 Electrical Fast Transient Immunity.
   f. EN61000-4-5 Surge Immunity.
   g. ENV50141 HF Conducted Disturbances Immunity.

D. Enclosure

1. The ATS/BPS shall be furnished in a NEMA type 1 enclosure unless otherwise shown on the plans.
2. All standard and optional door-mounted switches and pilot lights shall be 16mm industrial grade type or equivalent for easy viewing & replacement. Door controls shall be provided on a separate removable plate, which can be supplied loose for open type units.

2.03 OPERATION

A. Controller Display and Keypad

1. A four line, 20 character LCD display and keypad shall be an integral part of the controller for viewing all available data and setting desired operational parameters. Operational parameters shall also be available for viewing and limited control through the serial communications input port. The following parameters shall only be adjustable via DIP switches on the controller:
   a. Nominal line voltage and frequency
   b. Single or three phase sensing
   c. Operating parameter protection
   d. Transfer operating mode configuration: (Open transition, Closed transition or Delayed transition)
2. All instructions and controller settings shall be easily accessible, readable and accomplished without the use of codes, calculations, or instruction manuals.

B. Voltage, Frequency and Phase Rotation Sensing

1. Voltage and frequency on both the normal and emergency sources (as noted below) shall be continuously monitored, with the following pickup, dropout and trip setting capabilities (values shown as % of nominal unless otherwise specified):

Parameter	Sources	(Dropout/Trip)	(Pickup/ Reset)
Undervoltage	N&E,3ϕ	70 to 98%	85 to 100%
Overvoltage	N&E,3ϕ	102 to 115%	2% below trip
Underfrequency	N&E	85 to 98%	90 to 100%
Overfrequency	N&E	102 to 110%	2% below trip
Unbalance	N&E	5 to 20%	1% below dropout

2. Repetitive accuracy of all settings shall be within ± 0.5% over an operating temperature range of -20°C to 60°C.
3. Voltage and frequency settings shall be field adjustable in 1% increments either locally with the display and keypad or remotely via serial communications port access.
4. The controller shall be capable (when activated by the keypad or through the serial port) of sensing the phase rotation of both the normal and emergency sources. The source shall be considered unacceptable if the phase rotation is not the preferred rotation selected (ABC or CBA).
5. Source status screens shall be provided for both normal & emergency to pro-vide digital readout of voltage on all 3 phases, frequency, and phase rotation.

C. Time Delays

1. An adjustable time delay of 0 to 6 seconds shall be provided to override momentary normal source outages and delay all transfer and engine starting

signals. Capability shall be provided to extend this time delay to 60 minutes by providing an external 24 VDC power supply.

2. A time delay shall be provided on transfer to emergency, adjustable from 0 to 60 minutes, for controlled timing of transfer of loads to emergency.
3. Two time delay modes (which are independently adjustable) shall be provided on re-transfer to normal. One time delay shall be for actual normal power failures and the other for the test mode function. The time delays shall be adjustable from 0 to 60 minutes. Time delay shall be automatically bypassed if the emergency source fails and the normal source is acceptable.
4. A time delay shall be provided on shut down of engine generator for cool down, adjustable from 0 to 60 minutes.
5. A time delay activated output signal shall also be provided to drive an external relay(s) for selective load disconnect control. The controller shall have the ability to activate an adjustable 0 to 5 minute time delay in any of the following modes:
    a. Prior to transfer only.
    b. Prior to and after transfer.
    c. Normal to emergency only.
    d. Emergency to normal only.
    e. Normal to emergency and emergency to normal.
    f. All transfer conditions or only when both sources are available.
6. The controller shall also include the following built-in time delays for optional Closed Transition and Delayed Transition operation:
    a. 1 to 5 minute time delay on failure to synchronize normal and emergency sources prior to closed transition transfer.
    b. 0.1 to 9.99 seconds time delay on an extended parallel condition of both power sources during closed transition operation.
    c. 0 to 5 minute time delay for the load disconnect position for delayed transition operation.
7. All time delays shall be adjustable in 1 second increments, except the extended parallel time, which shall be adjustable in .01 second increments.
8. All time delays shall be adjustable by using the LCD display and keypad or with a remote device connected to the serial communications port.

D. Additional Features

1. A three position momentary-type test switch shall be provided for the test / automatic / reset modes. The test position will simulate a normal source failure. The reset position shall bypass the time delays on either transfer to emergency or retransfer to normal.
2. Auxiliary contacts, rated 10 amps, 250 VAC shall be provided consisting of one contact, closed when the ATS is connected to the normal source and one contact closed, when the ATS is connected to the emergency source.

3. LED indicating lights (16mm industrial grade, type 12) shall be provided; one to indicate when the ATS is connected to the normal source (green) and one to indicate when the ATS is connected to the emergency source (red).
4. LED indicating lights (16mm industrial grade, type 12) shall be provided and energized by controller outputs. The lights shall provide true source availability of the normal and emergency sources, as determined by the voltage sensing trip and reset settings for each source.
5. Provide the ability to select “commit/no commit to transfer” to determine whether the load should be transferred to the emergency generator if the normal source restores before the generator is ready to accept the load.
6. Terminals shall be provided for a remote contact that opens to signal the ATS to transfer to emergency and for remote contacts that open to inhibit transfer to emergency and/or retransfer to normal. Both of these inhibit signals can be activated through the keypad or serial port.
7. An inphase monitor shall be provided in the controller. The monitor shall control transfer so that motor load inrush currents do not exceed normal starting currents, and shall not require external control of power sources. The inphase monitor shall be specifically designed for and be the product of the ATS manufacturer. The inphase monitor shall be equal to ASCO Feature 27.
8. The controller shall be capable of accepting a normally open contact that will allow the transfer switch to function in a non-automatic mode using an external control device.
9. System Status -The controller LCD display shall include a “System Status” screen which shall be readily accessible from any point in the menu by depressing the “ESC” key a maximum of two times. This screen shall display a clear description of the active operating sequence and switch position. Controllers that require multiple screens to determine system status or display “coded” system status messages, which must be explained by references in the operator’s manual, are not permissible.
10. Self-Diagnostics -The controller shall contain a diagnostic screen for the purpose of detecting system errors. This screen shall provide information on the status-input signals to the controller that may be preventing load transfer commands from being completed.
11. Communications Interface –The controller shall be capable of interfacing, through an optional serial communication module, with a network of transfer switches, locally (up to 4000 ft.) or remotely through modem serial communications. Standard software specific for transfer switch applications shall be available by the transfer switch manufacturer. This software shall allow for the monitoring, control and setup of parameters.
12. Data Logging –The controller shall have the ability to log data and to maintain the last 99 events, even in the event of total power loss. The following events shall be time and date stamped and maintained in a non-volatile memory:
    a. Event Logging
        1) Data and time and reason for transfer normal to emergency.
        2) Data and time and reason for transfer emergency to normal.

3) Data and time and reason for engine start.
4) Data and time engine stopped.
5) Data and time emergency source available.
6) Data and time emergency source not available.

b. Statistical Data

1) Total number of transfers.
2) Total number of transfers due to source failure.
3) Total number of days controller is energized.
4) Total number of hours both normal and emergency sources is available.

13. Communications Module -A full duplex RS485 interface shall be installed in the ATS controller to enable serial communications. The serial communications shall be capable of a direct connect or multi-drop configured network. This module shall allow for the seamless integration of existing or new communication transfer devices. The serial communication interface shall be equal to ASCO Accessory 72.

2.04 WITHSTAND AND CLOSING RATINGS

A. The ATS/BPS shall be rated to close on and withstand the available RMS symmetrical short circuit current at the ATS/BPS terminals with the type of overcurrent protection shown on the plans.

B. The ATS/BPS shall be UL listed in accordance with UL 1008 and be labeled in accordance with that standard's 1½ and 3 cycle, long-time ratings. ATS/BPS's which are not tested and labeled with 1½ and 3 cycle (any breaker) ratings and have series, or specific breaker ratings only, are not acceptable.

2.05 POWER MANAGER

A. Furnish Power Managers to monitor all functions specified below for all ATS/BPS.

B. The Power Managers shall be listed to UL 3111-1, CSA, CE Mark, and industrially rated for an operating temperature range of -20 C to 60 C.

C. The Power Manager shall be accurate to 1% measured, 2% computed values and display resolution to .1%. Voltage and current for all phases shall be sampled simultaneously to assure high accuracy in conditions of low power factor or large waveform distortions (harmonics).

D. The Power Manager shall be capable of operating without modification at nominal frequencies of 45 to 66 Hz and over a control power input range of 20 - 32VDC.

E. Each Power Manager shall be capable of interfacing with an optional communications module to permit information to be sent to central location for display, analysis, and logging.

F. The Power Manager shall accept inputs from industry standard instrument transformers (120 VAC secondary PTs and 5A secondary CTs.) Direct phase voltage connections, 600 VAC and under, shall be possible without the use of PTs.

G. The Power Manager shall be applied in single, 3-phase, or three & four wire circuits. A fourth CT input shall be available to measure neutral or ground current.

H. All setup parameters required by the Power Manager shall be stored in non-volatile memory and retained in the event of a control power interruption.

I. The following metered readings shall be communicated by the Power Manager, via serial communication, when equipped with optional serial communications module:

1. Current, per phase RMS and neutral (if applicable)
2. Current Unbalance %
3. Voltage, phase-to-phase and phase-to-neutral
4. Voltage Unbalance %
5. Real power (KW), per phase and 3-phase total
6. Apparent power (KVA), per phase and 3-phase total
7. Reactive power (KVAR), per phase and 3-phase total
8. Power factor, 3-phase total & per phase
9. Frequency
10. Accumulated Energy, (MWH, MVAH, and MVARH)

J. The following energy readings shall be communicated by the Power Manager:

1. Accumulated real energy KWH
2. Accumulated reactive energy KVAH
3. Accumulated apparent energy KVARH

K. Power Manager Input/Output Options.

1. Power Managers shall be equipped with the following I/O:
   a. Provide (8) solid state status inputs.
   b. Provide four (4) relay output contacts

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine ATS to provide adequate clearances for installation.

B. Check that concrete pads (floor mounted models) and walls (wall mounted models) are level and free of irregularities.

C. Begin work only after unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. Install switchboard in location shown on Drawings, in accordance with manufacturer's written instructions. Anchor to resist seismic forces as inidicated on Drawings and in accordance with California Building Code anchorage requirements. Provide all testing and inspections requirements by inspecting authority.

B. Tighten accessible bus connection and mechanical fasteners after placing switchboard.

3.03 FIELD QUALITY CONTROL

A. Inspect complete installation for physical damage, proper alignment, anchorage and grounding prior to energizing.

B. Manufacturers' field services

1. The ATS/BPS manufacturer shall maintain a national service organization of company-employed personnel located throughout the contiguous United States. The service center's personnel must be factory trained and must be on call 24 hours a day, 365 days a year.

2. The manufacturer shall maintain records of each switch, by serial number, for a minimum of 20 years.

3.04 CLEANING

A. Touch up scratched or marred surfaces to match original finish

END OF SECTION

SECTION 26 43 13 – TRANSIENT VOLTAGE SURGE SUPPRESSORS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes

1. Provide all labor, materials and equipment necessary to complete the installation required for the items specified under this Section, including but not limited to transient voltage surge suppressors (TVSS).

B. Related sections

1. Where items specified in other Division 26 sections conflict with the requirements of this Section, the most stringent requirement shall govern.
    a. 26 05 26 – Grounding and Bonding for Electrical Systems
2. The requirements of this Section apply to all Division 26 work, as applicable.
3. Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified:

1. ANSI - American National Standards Institute
    a. C62.11; Metal-Oxide Surge Arresters for Alternating Current Power Circuits
    b. C62.33; Standard Test Specifications for Varistor Surge-Protective Devices
    c. C62.41; Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits
    d. C62.45; Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000V and Less) AC Power Circuits
2. CCR –California Code of Regulations, Title 24
    a. Part 3 -California Electrical Code(CEC); NFPA 70 National Electrical Code (NEC) with California amendments
3. IEEE –Institute of Electrical and Electronic Engineers
    a. 446; Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications
    b. 1100; Recommended Practices Powering and Grounding Electronic Equipment
4. Military Specification
    a. MIL-STD-220; Test Method Standard, Method of Insertion Loss Measurement

5. NEMA –National Electrical Manufacturer's Association
   a. LS1; Low Voltage Surge Protection Devices
6. UL -Underwriters Laboratories, Inc.
   a. 50; Standard for Enclosures for Electrical Equipment
   b. 67; Standard for Panelboards
   c. 845; Standard for Motor Control Centers
   d. 857; Busways
   e. 1283; Standard for Electromagnetic Interference Filters
   f. 1449; Standard for Transient Voltage Surge Suppressors

1.03 SYSTEM DESCRIPTION

A. The TVSS shall be a parallel design transient voltage surge suppression system integrated into panelboards and distribution panels. The system shall utilize diversion modules to suppress and divert transient voltage and surge currents. The system shall be designed to provide protection for sensitive electronic devices against the effects of surges, transients and electrical line noises.

1.04 SUBMITTALS

A. Submit manufacturer's data for materials specified within this Section in accordance to Section 26 05 00.

1.05 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the materials specified herein shall be new and unused, bearing UL labels where applicable.

1.06 DELIVERY, STORAGE AND HANDLING

A. Handle carefully to avoid damage to internal components, enclosure and finish.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. APT, Current Technology, Cutler-Hammer or approved equal.

2.02 GENERAL

A. Electrical Requirements
   1. Unit Operating Voltage – Refer to drawings for operating voltage and unit configuration.
   2. Maximum Continuous Operating Voltage (MCOV) – The MCOV shall be greater than 115% of the nominal system operating voltage.

3. The suppression system shall incorporate a hybrid designed Metal-Oxide Varistors (MOV) surge suppressor for the service entrance and other distribution level. The system shall not utilize silicon avalanche diodes, selenium cell, air gaps or other components that may crowbar the system voltage leading to system upset or create any environmental hazards.
4. Protection Modes – For a wye configured system, the device must have directly connected suppression elements between line-neutral (L-N), line-ground (L-G), and neutral-ground (N-G). For a delta-configured system, the device must have suppression elements between line to line (L-L) and line to ground (L-G).
5. UL 1449 2nd Edition Suppressed Voltage Rating (SVR) – The maximum UL 1449 2nd Edition SVR for the device must not exceed the following:
    a. Voltage: L-N; L-G; N-G & L-L modes
    b. 208Y/120: 400V & 800V
    c. 480Y/277: 800V & 1800V
    d. 600Y/347: 1200V & 1800V
6. – The let through voltage based on IEEE C62.41 and C62.45 recommended procedures for Category C3 surges (20 kV, 10 kA) shall be less than:
    a. Voltage: L-N
    b. 208Y/120: 560V
    c. 480Y/277: 960V
    d. 600Y/347: 1840V
7. ANSI/IEEE Cat. B3 Let Through Voltage – Let through voltage based on IEEE C62.41 and C62.45 recommended procedures for the ANSI/IEEE Cat. B3 ringwave (6 kV, 500 amps) shall be less than:
    a. Voltage: L-N
    b. 208Y/120: 160V
    c. 480Y/277: 165V
    d. 600Y/347: 168V

B. TVSS Design

1. Balanced Suppression Platform – The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV. Designs incorporating TVSS modules shall not be acceptable.
2. Electrical Noise Filter – Each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be 50 dB at 100 kHz using the MIL-STD-220A insertion loss test method. Products not able to demonstrate noise attenuation of 50 dB @ 100 kHz shall be rejected.
3. Extended Range Filter –The Surge Protective Device shall have a High Frequency Extended Range Tracking Filter in each Line to Neutral mode with compliance to UL 1283 and NEMA LS1. The filter shall have published high frequency attenuation rating in the attenuation frequencies.

a. Attenuation Frequency - Insertion Loss (ratio) - Insertion Loss (dB)

b. 50kHz -40 -32

c. 100kHz -316 -50

d. 500kHz -318 -50

e. 1MHz -89 -39

f. 10MHz -200 -46

g. 100MHz -79 -38

4. Internal Connections – No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall be hardwired with connections utilizing low impedance conductors and compression fittings.

5. Standard Monitoring Diagnostics – Each TVSS shall provide integral monitoring options:

   a. Each unit shall provide a green / red solid state indicator light shall be provided on each phase. The absence of a green light and the presence of a red light, shall indicate which phase(s) have been damaged.

   b. Remote Status Monitor – The TVSS device must include form C dry contacts (one NO and one NC) for remote annunciation of unit status. The remote alarm shall change state if any of the three phases detect a fault condition.

   c. Audible Alarm – The TVSS shall provide an audible alarm with a reset pushbutton that will be activated under any fault condition.

   d. Event Counter – The TVSS shall be equipped with an LCD display system designed to indicate to the user how many surges, sags, swells and outages have occurred at the location. The event-counter triggers each time under each respective category after significant event occurs. A reset pushbutton shall also be standard allowing all counters to be zeroed.

   e. Push to Test – The TVSS shall be equipped with push-to-test feature, designed to provide users with real time testing of the suppressor's monitoring and diagnostic system. By depressing the test button, the diagnostic system initiates a self test procedure. If the system is fully operational, the self test will activate all indicator lights.

   f. Voltage Monitoring – The TVSS shall display true Root Mean Square (RMS) on three L-N voltage protection mode on Wye configuration and three L-L voltage on delta configuration.

6. Overcurrent Protection Fusing: In order to isolate the TVSS under any fault condition, the manufacturer shall provide:

   a. Individual Fusing: MOV's shall be individually fused via Copper Fuse Trace. The Copper Fuse shall allow protection during high surge (kA) events.

   b. Thermal Protection: MOV's shall be equipped with Thermal Fuse Spring (TFS) technology which allows disconnection of the suppression component at the overheated stage common during temporary over voltage condition. For small fault currents between 100mA to 30Amp, or if the occurrence is over a longer period of time, the TFS will disconnect first. Manufacturers that

utilize fuse trace only shall not be approved since there is no fault current protection between 100mA to 30A.

c. All overcurrent protection components shall be tested in compliance with UL 1449-Limited Current Test and AIC rating test.

C. Minimum Repetitive Surge Current Capability as per ANSI/IEEE C62.41 and ANSI/IEEE C62.45 – 1992

1. The suppression filter system shall be repetitive surge tested in every mode utilizing a 1.2 x 50µsec, 20kV open circuit voltage. 8 x 20µsec, 10kA short circuit current Category C3 bi-wave at one minute intervals without suffering either performance degradation or more than 10% deviation of clamping voltage at a specified surge current. The minimum repetitive surge current capability as per ANSI/IEEE C62.41 and ANSI/IEEE C62.45 – 1992 shall be:

a. Service Entrance: 12000 impulse per mode.

b. Distribution Panelboard: 10000 impulse per mode.

c. Branch Location Panelboard: 9000 impulse per mode.

2.03 SYSTEM APPLICATION

A. The TVSS applications covered under this section include distribution and branch panel locations, bus plugs, motor control centers (MCC), switchgear, and switchboard assemblies. The branch panel located TVSS shall be tested and demonstrate to be suitable for ANSI/IEEE C62.41 Category C1 environments.

1. Surge Current Capacity - The minimum total surge current 8 x 20 microsecond waveform that the device is capable of withstanding in compliance to ANSI/IEEE C62.41 AND NEMA LS1

a. Application -Service Entrance Locations (Switchboards Switchgear, MCC Main Entrance)

1) 250kA Per Phase

2) 125kA Per Mode

3) 12,000 Surge Withstand Capabilities ANSI/IEEE C3 Wave (10kA)

2. Application -High Exposure Roof Top Locations (Distribution Panelboards)

1) 160kA Per Phase

2) 80kA Per Mode

3) 9,000 Surge Withstand Capabilities ANSI/IEEE C3 Wave (10kA)

3. Application -Branch Locations (Panelboards, MCCs, Busway)

1) 120kA Per Phase

2) 60kA Per Mode

3) 5,000 Surge Withstand Capabilities ANSI/IEEE C3 Wave (10kA)

B. Lighting and Distribution Panelboard Requirements

1. The TVSS application covered under this section includes lighting and distribution panelboards. The TVSS units shall be tested to demonstrate suitability for ANSI/IEEE C62.41 Category C1 environments.
2. The TVSS shall not limit the use of Through-feed lugs, Sub-feed lugs and Sub-feed breaker options.
3. The TVSS shall be immediately installed on the load side of the main breaker.
4. The panelboard shall be capable of re-energizing upon removal of the TVSS.
5. A direct bus bar connection shall be used to mount the TVSS component to the panelboard bus bar to reduce the impedance of the shunt path.
6. The TVSS panelboard shall be constructed using a direct bus bar connection (cable connection between bus bar and TVSS device is not acceptable). TVSS units that use a cable connection do not meet the intent of this specification.
7. The TVSS shall be included and mounted within the panelboard by the manufacturer of the panelboard.
8. The complete panelboard including the TVSS shall be UL67 listed.

C. Retrofit Installation (externally mounted suppressor). Maximum conductor lead length between breaker and suppressor shall not exceed 14 inches. Comply with the manufacturer's recommended installation and wiring practices.

D. Switchgear, Switchboard, MCC and Busway/ Bus Plug Requirements

1. The TVSS application covered under this section is for switchgear, switchboard, MCC and Bus Plug locations. Service entrance located TVSS shall be tested and suitable for ANSI/IEEE C62.41 Category C3 environments.
2. The TVSS shall be factory installed inside the switchgear, switchboard, MCC and Bus Plug at the assembly point by the original equipment manufacturer.
3. Locate suppressor on load side of main disconnect device, as close as possible to the phase conductors and ground/neutral bar.
4. Provide a 30-amp disconnect. The disconnect shall be directly integrated to the suppressor and assembly bus using bolted bus bar connections.
5. The TVSS shall be integral to switchgear, switchboard, MCC and Bus Plug as factory standardized design.
6. All monitoring diagnostics features shall be visible from the front of the equipment.

2.04 ENCLOSURES

A. All enclosed equipment shall have NEMA 1/3R general purpose enclosures, unless otherwise noted.

PART 3 - EXECUTION

3.01 INSTALLATION

A. The Contractors shall install all equipment per the manufacturer's recommendations and the contract drawings.

B. Provide TVSS protection for electrical equipment where indicated on Drawings.

C. External and Retrofit TVSS Applications

1. Conductors from the power source to TVSS shall be #4 AWG copper with absolute maximum length of 84” in Service Entrance Locations (Switchboards, Switchgear, MCC Main Entrance) & #8 AWG copper with absolute maximum length of 12” in all other applications.

2. Conductors shall be routed without sharp bends and straight and short as possible.

3. External cabinets shall be anchored and braced to withstand seismic forces.

3.02 FIELD QUALITY CONTROL

A. Prior to energizing TVSS inspect for physical damage, defects, alignment and fit; verify nameplate information with application and Drawings; and check tightness of all control and power connections.

END OF SECTION

SECTION 26 50 00 – LIGHTING

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes

1. Provide all labor, materials and equipment necessary to complete the installation required for the items specified under this Section, including but not limited to fixtures, lamps, standards, bases, hangers, supports, reflectors, glassware, lenses, auxiliary equipment, ballasts and sockets.

B. Related work under this section

1. Where items specified in other Division 26 sections conflict with the requirements of this Section, the most stringent requirement shall govern.
2. The requirements of this Section apply to all Division 26 work, as applicable.
3. Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified:

1. ANSI -American National Standards Institute
   a. C78; American National Standard for Electric Lamps
   b. C81; American National Standard for Electric Lampholders
   c. C82; American National Standard for Lamp Ballasts
   d. C136; American National Standard for Roadway and Area Lighting Equipment
2. California Codes of Regulations
   a. Part 3 -California Electrical Code(CEC); NFPA 70 National Electrical Code (NEC) with California amendments
   b. Part 6 -California Energy Code
3. IESNA –Illuminating Engineering Society of North America
   a. RP-16; Nomenclature and Definitions for Illuminating Engineering
4. NECA –National Electrical Contractors Association
   a. NECA/IESNA 500, Recommended Practice for Installing Indoor Commercial Lighting Systems
   b. NECA/IESNA 501, Recommended Practice for Installing Exterior Lighting Systems

c. NECA/IESNA 502, Recommended Practice for Installing Industrial Lighting Systems

5. UL -Underwriter's Laboratories, Inc.
   a. 935; Standard for Fluorescent-Lamp Ballasts
   b. 1029; Standard for High-Intensity-Discharge Lamp Ballasts
   c. 1574; Standard for Track Lighting Systems

1.03 SUBMITTALS

A. Submit manufacturer's data for materials specified within this Section in accordance to Section 26 05 00.

B. Substituted fixtures shall be submitted with manufacturer's specification sheet and published photometric reports, verified by testing to IES and NEMA standards under controlled laboratory conditions.

1.04 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the materials specified herein shall be new and unused, bearing UL labels where applicable.

B. Installation shall conform to the following standards:
   1. NECA/IESNA 500, Recommended Practice for Installing Indoor Commercial Lighting Systems
   2. NECA/IESNA 501, Recommended Practice for Installing Exterior Lighting Systems
   3. NECA/IESNA 502, Recommended Practice for Installing Industrial Lighting Systems

1.05 DELIVERY, STORAGE AND HANDLING

A. Handle carefully to avoid damage to internal components, enclosure and finish.

B. Store in a clean, dry environment. Maintain factory packaging and, if required, provide an additional cover to protect enclosure in harsh environments.

1.06 WARRANTY

A. Furnish one-year guarantee in accordance with and in form required under Section 26 05 00.

PART 2 - PRODUCTS

2.01 GENERAL

A. Fixtures shall be of the types, wattages and voltages shown on Drawings.

B. Fixtures shall be UL listed as an entire assembly and for the installed location.

C. Fixtures' mounting trim shall be compatible with ceiling material, coordinate with Architect Drawings for each location. Fixtures delivered which are not compatible shall be returned and replaced at Contractor's expense.

D. Luminaire recessed in fire rated ceiling shall conform to UL Standards, equipped with yoke where in tee ceiling and field fabricated fire protection box in accordance with latest UL Fire Resistance Directory.

E. Fluorescent luminaire lenses shall be Pattern 12 of 100% virgin acrylic with 0.125" thickness except shown or specified otherwise.

F. Equip exposed fluorescent lamps with safety lamp holders or wire guard.

G. Deliver fixtures and other lighting equipment complete with suspension accessories, canopies, castings, sockets, holders, reflectors, ballasts, diffusing material, louvers, frames, and recessing boxes all wired and assembled.

H. Hangers: Swivel-type to allow for free movement of 45 degrees from vertical at canopy and at luminaire housing. Steel tube hangers shall include a 1/16-inch diameter galvanized wire cord or equivalent (100-pound break strength) in stem assembly attached to luminaire housing and building structure. Attach loop with C-type tool applied compression splice.

I. All metal halide lamp luminaires shall be the enclosed type with diffuser or lens to withstand an arc tube rupture.

J. Louvers for fluorescent luminaires which are removable for re-lamping but not hinged shall be securely fastened near each end between the fixture housing and louvers using No. 16 jack chain.

2.02 BALLASTS

A. Ballast(s) in luminaire recessed in fire rated ceiling shall be approved for such use.

B. Ballast installed indoors shall be of encapsulated type for noise control.

C. Use appropriate rated ballast in high or low temperature applications.

D. Compact fluorescent and fluorescent lamp ballasts

1. Ballasts shall be programmed rapid start.
2. Ballasts shall be UL 935 listed, Class P, Type 1 Outdoor, CSA Certified where applicable.
3. The ballast shall meet or exceed ANSI C82.11, where applicable.
4. The ballast shall withstand transients specified within ANSI C62.41 Cat. A.
5. THD (Total Harmonic Distortion) shall be less than 10%.
6. Ballast power factor shall be greater than 98%.
7. The ballast shall have an audible noise rating of Class A or better.

E. High intensity discharge (HID) lamp ballasts

1. Ballasts shall be premium constant wattage (regulator stabilized) type, designed in accordance with all applicable ANSI specifications including ANSI C82.4 and UL 1029.

2. Power factor shall be greater than 90%.
3. Provide protective fusing with HID ballasts or HID fixtures.

F. Lamps

1. Provide lamps in all lighting fixtures shown.
2. Type as noted on the plans, T8 unless noted otherwise.
3. Approved manufacturers are General Electric, Osram Sylvania or equal.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Locate all lighting fixtures by reference to Drawings, both electrical and architectural.

B. Report proposed changes for luminaire locations found necessary due to interference with structure, pipes, ducts, and other items to Owner's representative for direction before installation. Luminaires specified with overall lengths are subject to change. Adjust as directed by Owner's representative.

C. Contractor shall be responsible to coordinate with ceiling installation trade. This will assure that proper fixture type will be furnished to match ceiling system specified.

3.02 INSTALLATION

A. Luminaires shall be properly grounded per CEC Article 410, Parts 17 through 21.

B. Luminaires recessed in fire rated ceilings shall be in accordance with UL Fire Resistance Directory.

C. Install all luminaires true and plumb. Support and mount in accordance manufacturer's instructions and with CEC Article 410, Parts 16 and 76.

D. Install recessed luminaires with separate junction box, flexible conduit, and heat-resisting wire as required by CEC. Set junction box in furred space facing luminaire for maximum accessibility. Furnish and install metal ceiling frame so luminaire can be removed without damaging finish.

E. Suspended ceiling mounting

1. Attach all light fixtures to ceiling grid runners to resist a horizontal force equal to the weight of the fixtures. Use a #10 Tek-screw or approved fastener.
2. Flush or recessed light fixtures weighing less than 56lbs. May be supported directly on runners of a heavy duty grid system, but in addition, they must have a minimum of (2) 12ga slack safety wires attached to the fixtures at diagonal corners and anchored to the structure above in the same fashion as the grid system. All 4'x4' light fixtures must have slack safety wires at each corner.
3. All flush or recessed light fixtures 56lbs. Or greater must be independently supported by not less than (4) taut 12ga wires each attached to the fixture and the structure above regardless of the grid system used. The 4 taut 12ga wires including their attachment to the structure above must be capable of supporting 4 times the fixture weight.

4. All light fixtures supported on intermediate grid system must be independently supported by not less than (4) taut 12ga wires each attached to the fixture and the structure above.
5. Support surface mounted light fixtures by at least 2 positive devices which surround the ceiling runner and which are each supported from the structure above by a 12ga wire. Spring clips or clamps that connect only to the runner are not acceptable. Provide additional supports for 8' or longer fixtures.
6. Support pendant mounted light fixtures directly from the structure above with hanger wires of cables passing through each pendant hanger & capable of supporting 4 times the fixture weight.

3.03 ADJUSTING

A. Particular care shall be used to eliminate light leaks around edge of recessed fixture trims.

3.04 CLEANING

A. Clean all glass and plastic and polish all visible metal parts before submitting job to Owner's representative for final acceptance. Remove all fingerprints and dirt from exposed surfaces. Replace scratched or damaged components.

END OF SECTION

SECTION 27 05 26 – GROUNDING AND BONDING FOR COMMUNICATIONS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes

a. Provide all labor, materials and equipment necessary to complete the installation required for the item specified under this Section, including but not limited to telecommunication system grounding.

B. Related sections

1. Where items specified in other Division 27 sections conflict with the requirements of this Section, the most stringent requirement shall govern.
2. The requirements of this Section apply to all Division 27 work, as applicable.
3. Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified:

1. CCR –California Code of Regulations, Title 24
   a. Part 3 -California Electrical Code(CEC); NFPA 70 National Electrical Code (NEC) with California amendments
2. IEEE –Institute of Electrical and Electronic Engineers
   a. 1100; Recommended Practices Powering and Grounding Electronic Equipment
3. NFPA –National Fire Protection Association
   a. 780; Lightning Protection Code
4. TIA/EIA – Telecommunications Industry Association/Electronic Industries Alliance
   a. 607; Commercial Building Grounding and Bonding Requirements for Telecommunications
5. UL -Underwriters Laboratories, Inc.
   a. 467; Grounding and Bonding Equipment

1.03 SYSTEM DESCRIPTION

A. This Section provides for the grounding and bonding of all electrical and communication apparatus, appliances, components, fittings and accessories where required to provide a permanent, continuous, low impedance, grounded electrical system.

B. Except as otherwise indicated, the complete electrical installation including equipment and metallic raceways, boxes and cabinets shall be completely and effectively grounded in accordance with all Code requirements, whether or not such connections are specifically shown or specified.

C. Provide telecommunication system ground bus bars with each building main telecommunications equipment room or cabinet/rack location. Provide connection between the bus bar and main building reference ground bus, the ground bus of the panelboard serving power to telecommunication equipment, and all telecommunication conduit, cable trays, cable ladders and boxes.

1.04 SUBMITTALS

A. Submit manufacturer's data for equipment and materials specified within this Section in accordance to Section 26 05 00.

1.05 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the materials specified herein shall be new and unused, bearing UL labels where applicable.

PART 2 - PRODUCTS

2.01 INSULATED GROUNDING BUSHINGS

A. Plated malleable iron body with 150°C molded plastic insulated throat and lay-in ground lug; OZ/Gedney BLG, Thomas & Betts #TIGB series or equal.

2.02 CONNECTIONS TO STRUCTURAL STEEL, GROUND RODS OR SPICES

A. Where required by the Drawings, grounding conductors shall be spliced together, connected to ground rods or connected to structural steel using exothermic welds, Cadweld or equal, or high pressure compression type connectors, Cadweld, Thomas & Betts or equal.

2.03 BONDING JUMPERS

A. OZ/Gedney Type BJ, Thomas & Betts #3840 series or equal.

2.04 GROUND CONDUCTOR

A. Ground conductor shall be #6 AWG UL labeled, Type THWN insulated copper wire, green in color.

2.05 TELECOMMUNICATION MAIN GROUNDING BUS BAR (TMGB)

A. Provide grounding bus bar at telecommunication backboards, racks and cabinets of the following type:

1. Backboards 4'X8' and greater, floor mounted telecommunication equipment racks/cabinets larger than 60" height or wall mounted cabinets greater than 36"Wx36"H

a. Provide 1 13.5”x2”x1/4” TK copper bus bar mounted on wall with insulating stand-offs at +96” AFF. Furnish complete with cast copper alloy body Thomas Betts Series 310 or equal lugs for connecting grounding conductors. Attach lugs to bus with appropriate size bronze bolt, flat washer and Belleville washer. All connections shall be torque, and all holes shall be drilled and tapped for single hole lugs. Provide 4 spare lugs with respective spaces.

2. Backboards less than 4’X8’, floor/wall mounted telecommunication equipment racks/cabinet less than 60” or wall mounted cabinets less than 36”Wx36”H

   a. Provide an aluminum loadcenter ground kit with 14 terminals minimum, General Electric TGL2 or equal. A minimum of 3 terminals shall accommodate #6 AWG. Mount within enclosure or on backboard at +96” AFF.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Telecommunication system grounding

1. Bond all telecommunication conduit, cable tray, ladder rack, equipment racks and all other metallic telecommunication infrastructure components to the nearest TMGB using a #6 AWG conductor.
2. Provide #6 AWG ground within ¾” conduit from each secondary backboard, cabinet, rack, etc. to the BGB.
3. Install #6 AWG grounding conductor in nonmetallic underground raceways containing only fiber optic cable.
4. Provide an engraved nameplate mechanically fastened to wall or enclosure adjacent to each TMGB. Nameplate shall be blue with ¼” high white lettering to read “TMGB-(name of enclosure or building)”.

3.02 FIELD QUALITY CONTROL

A. Contractor using test equipment expressly designed for that purpose shall perform all ground resistance tests in conformance with IEEE Standard 1100. Contractor shall submit typewritten records of measured resistance values to Engineer for review and approval prior to energizing the system.

B. Obtain and record ground resistance measurements both from electrical equipment ground bus to the ground electrode and from the ground electrode to earth. Furnish and install additional bonding and add grounding electrodes as required to comply with the following resistance limits:

1. Resistance from ground bus to ground electrode and to earth shall not exceed 5 ohms unless otherwise noted.
2. Resistance from the farthest panelboard, loadcenter, switchboard or motor control center ground bus to the ground electrode and to earth shall not exceed 20 ohms maximum.

C. Obtain and record ground resistance measurements (DC, 60Hz, 10MHz, 20MHz, 33 MHz, 66MHz and 100MHz) both from each TMGB to the ground electrode and from the ground electrode to earth.

D. Inspection

1. The Engineer or Inspector prior to encasement, burial or concealment thereto shall review the grounding electrode and connections.

END OF SECTION

SECTION 27 05 28 – PATHWAYS FOR COMMUNICATION SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes

1. Provide all labor, materials and equipment necessary to complete the installation required for the items specified under this Section, including but not limited to electrical conduits; outlet, junction and pull boxes; and related supports.

B. Related sections

1. Where items specified in other Division 27 sections conflict with the requirements of this Section, the most stringent requirement shall govern.
    a. 27 05 26 – Grounding and Bonding for Electrical Systems
2. The requirements of this Section apply to all Division 27 work, as applicable.
3. Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified:

1. ANSI –American National Standards Institute
    a. C33.91; Specification for Rigid PVC Conduit
    b. C80.1; Specification Rigid Steel Conduit, Zinc-Coated
    c. C80.3; Specification for Electrical Metallic Tubing, Zinc-Coated
    d. C80.6; Intermediate Metal Conduit (IMC), Zinc-Coated
2. CCR –California Code of Regulations, Title 24
    a. Part 2 -California Building Code (CBC); International Building Code (IBC) with California amendments
    b. Part 3 -California Electrical Code(CEC); NFPA 70 National Electrical Code (NEC) with California amendments
3. NECA –National Electrical Contractors Association
    a. 101, Standard for Installing Steel Conduit (Rigid, IMC, EMT)
    b. 111, Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC) (ANSI)
4. NEMA –National Electrical Manufacturer’s Association
    a. FB 1; Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable

b. FB 2.10; Selection and Installation Guidelines for Fittings for Use with Non-flexible Electrical Metal Conduit or Tubing (Rigid Metal Conduit, Intermediate Metal Conduit, and Electrical Metallic Tubing)

c. FB 2.20; Selection and Installation Guidelines for Fittings for Use with Flexible Electrical Conduit and Cable

d. OS 1; Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports

e. OS 3; Selection and Installation Guidelines for Electrical Outlet Boxes

f. RN 1; Polyvinyl-Chloride Externally Coated Galvanized Rigid Steel Conduit and Electrical Metallic Tubing.

g. TC 2; Electrical Plastic Tubing and Conduit

h. TC 3; PVC Fittings for Use with Rigid PVC Conduit and Tubing

i. TC 14; Reinforced Thermosetting Resin Conduit (RTRC) and Fittings

5. OSHPD Anchorage Pre-approvals

a. OPA-0003; Superstrut Seismic Restraint System

b. OPA-0114; B-Line Seismic Restraints

c. OPA-0120; Unistrut Seismic Bracing System

d. OPA-0242; Power-Strut Seismic Bracing System

6. UL –Underwriter's Laboratories, Inc.

a. 1; Standard for Flexible Metal Conduit

b. 6; Rigid Metal Electrical Conduit

c. 360; Standard for Liquid-Tight Flexible Steel Conduit

d. 514A; Metallic Outlet Boxes, Electrical

e. 514B; Fittings for Conduit and Outlet Boxes

f. 651; Schedule 40 & 80 PVC Conduit

g. 797; Electrical Metallic Tubing

h. 1242; Intermediate Metal Conduit

i. 1684; Reinforced Thermosetting Resin Conduit (RTRC) and Fittings

1.03 SYSTEM DESCRIPTION

A. Furnish, assemble, erect, install, connect and test all electrical conduits and related raceway apparatus required and specified to form a complete installation.

1.04 SUBMITTALS

A. Submit manufacturer's data for materials specified within this Section in accordance to Section 26 05 00.

1.05 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the materials specified herein shall be new and unused, bearing UL labels where applicable.

B. Installation shall conform to the NECA installation guidelines unless otherwise indicated within this Section

PART 2 - PRODUCTS

2.01 MATERIALS

A. Conduits and Fittings

1. Rigid steel conduit (RMC)

a. Conduit: Standard weight, mild steel pipe, and zinc coated on both inside and outside by a hot dipping or shearardizing process manufactured in accordance with UL 6 and ANSI C80.1 specifications.

b. Fittings (couplings, elbows, bends, etc.)

1) Shall be steel or malleable iron.

2) Coupling and unions shall be threaded type, assembled with anti-corrosion, conductive and anti-seize compound at joints made absolutely tight to exclude water.

c. Bushings

1) Insulating bushings: Threaded polypropylene or thermosetting phenolic rated at 150°C minimum.

2) Insulating grounding bushing: Threaded cast body with insulating throat and steel “lay-in” ground lug.

3) Insulating metallic bushing: Threaded cast body with plastic insulated throat rated at 150°C minimum.

2. Coated rigid steel conduit (CRMC)

a. Conduit: Equivalent to RMC with a Polyvinyl chloride (PVC) coated bonded to the galvanized outer surface of the conduit. The bonding between the PVC coating and conduit surface shall be ETL PVC-001 compliant. The coating thickness shall be a minimum of 40mil.

b. Fittings (couplings, elbows, bends, etc.)

1) Equivalent to RMC above with bonded coating same as conduit.

2) The PVC sleeve over fittings shall extend beyond hub or coupling approximately one diameter or 1 1/2” whichever is smaller.

c. Bushing equivalent to RMC above.

3. Intermediate metallic conduit(IMC)
    a. Conduit: Intermediate weight, mild steel pipe, meeting the same requirements for finish and material as rigid steel conduit manufactured in accordance with UL 1242 and ANSI C80.6 specifications.
    b. Fittings (couplings, elbows, bends, etc.) equivalent to RMC above.
    c. Bushing equivalent to RMC above.
4. Electrical metallic tubing (EMT)
    a. Conduit: Cold rolled steel tubing with zinc coating on outside and protective enamel on inside manufactured in accordance with UL 797 and ANSI C80.3 specifications.
    b. Couplings: Steel or malleable iron with compression type fastener via a nut.
    c. Connectors: Steel or malleable iron with compression type fastener via a nut with plastic insulated throat rated at 150°C minimum.
5. Rigid non-metallic conduit (PVC)
    a. Conduit: PVC composed Schedule 40, 90°C manufactured in accordance with NEMA TC 2 and UL 651 specifications.
    b. Fittings: Molded PVC, slip on solvent welded type in accordance to NEMA TC 3.
6. Reinforced thermosetting resin conduit (RTRC)
    a. Conduit: Fiber impregnated with a cured thermosetting resin compound in accordance with NEMA TC 14 and UL1684.
    b. Fittings: Molded resin with glass reinforcement manufactured in the same process as the conduit bonded with an epoxy adhesive.
7. Flexible metallic conduit (FMC)
    a. Conduit: Continuous, flexible steel spirally wound with zinc coating on both inside and outside in accordance with UL 1.
    b. Connectors: Steel or malleable iron with compression type fastener via a nut with plastic insulated throat rated at 150°C minimum.
8. Liquidtight flexible metallic conduit (LFMC)
    a. Conduit: PVC coated, continuous, flexible steel spirally wound with zinc coating on both inside and outside in accordance with UL 360.
    b. Connectors: Steel or malleable iron with compression type fastener via a nut with plastic insulated throat rated at 150°C minimum.
9. Miscellaneous Fittings and Products
    a. Conduit sealing bushings: Steel or cast malleable iron body and pressure clamps with PVC sleeve, neoprene sealing grommets and PVC coated steel pressure rings. Supplied with neoprene sealing rings between body and PVC sleeve.

b. Watertight cable terminators: One piece, compression molded sealing ring with PVC coated steel pressure disks, stainless steel screws and zinc plated cast iron locking collar.

c. Watertight cable/cord connectors: Liquidtight steel or cast malleable iron body with sealing neoprene bushing and stainless steel retaining ring.

d. Expansion fittings: Multi-piece unit of hot dip galvanized malleable iron or steel body and outside pressure bussing design to allow a maximum of 4" movement (2" in either direction). Furnish with external braid tinned copper bonding jumper. UL listed for both wet and dry locations.

e. Expansion/deflection couplings: Multi-piece unit comprised of a neoprene sleeve, internal flexible tinned copper braid attached to bronze end couplings with stainless steel bands. Coupling to provide minimum of 3/4" movement and 30 degrees deflection from normal. UL listed for both wet and dry locations.

f. Conduit bodies: Raintight, malleable iron, hot-dip galvanized body with threaded hubs, stamped steel cover, stainless steel screws and neoprene gasket.

g. Other couplings, connectors and fittings shall be equal in quality, material and construction to items specified herein.

B. Boxes

1. Outlet boxes

a. Standard: Galvanized one-piece of welded pressed steel type in accordance with NEMA OS 1 and UL 514. Boxes shall not be less than 4" square and at least 1 1/2" deep.

b. Concrete: Galvanized steel, 4" octagon ring with mounting lug, backplate and adapter ring type in accordance with NEMA OS 1 and UL 514. Depth as required by application.

c. Masonry: Galvanized steel, 3.75" high gang box in accordance with NEMA OS 1 and UL 514.

d. Surface cast metal: Cast malleable iron body, surface mounted box with threaded hubs and mounting lugs as required in accordance with NEMA OS 1 and UL 514. Furnish with ground flange, steel cover and neoprene gasket.

2. Pull and junction boxes

a. Sheet metal boxes: Standard or concrete outlet box wherever possible; otherwise use 16 gauge galvanized sheet metal, NEMA 1 box sized per CEC with machine screwed cover.

b. Cast metal boxes: Install standard cast malleable iron outlet or device box when possible.

c. Flush mounted boxes: Install overlapping cover with flush head screws.

d. In-ground mounted pull holes/boxes: Install pre-cast concrete box, sized per Drawing or CEC with pre-cast or traffic rated lid.

3. Floor boxes

   a. Floor boxes shall be adjustable, cast metal body with threaded conduit openings, adjustable rings, brass flange or Lexan ring and cover plate with threaded plug. Include provisions to accommodate surface mounted telephone or receptacle outlet, or flush floor mounted telephone or receptacle outlet where shown on Drawings.

C. Pull line/cord

1. Polypropylene braided line or Let-line #232 or equal of 1/8” diameter with a minimum break strength of 200 pounds.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Thoroughly examine site conditions for acceptance of wire and cable installation to verify conformance with manufacturer and specification tolerances. Do not commence with work until all conditions are made satisfactory.

3.02 PREPARATION

A. Conduit

1. Provide all necessary conduit fittings, connectors, bushings, etc. required to complete conduit installation to meet the CEC/NEC and intended application whether noted, shown or specified within.
2. Location of conduit runs shall be planned in advance of the installation and coordinated with other trades.
3. Where practical, install conduits in groups in parallel vertical or horizontal runs that avoid unnecessary offsets.
4. All conduits shall be parallel or at right angles to columns, beams and walls whether exposed or concealed.
5. Conduits shall not be placed closer than 12” to a flue, parallel to hot water, steam line or other heat sources; or 3” when crossing perpendicular to the above said lines when possible.
6. Install exposed conduit as high as practical to maintain adequate headroom. Notify Engineer if headroom will be less than 102”.
7. Do not obstruct spaces required by Code in front of electrical equipment, access doors, etc.
8. The largest trade size conduit in concrete floors and walls shall not exceed 1/3 thickness or be spaced a less than three conduit diameters apart unless permitted by Engineer. All conduits shall be installed in the center of slab or wall, and never between reinforcing steel and bottom of floor slab.

9. Install additional pull boxes, not shown on Drawings, in sufficient quantities to facilitate pulling of conductors and cables such that total spacing does not exceed 150 feet or 270 degrees, total; and maximum pulling tension will not be exceeded.
10. When installing underground conduits to specified depth; depth shall be taken from finished grade as it will be at project completion. Should finish grade be above existing grade by an amount equal to or greater than specified depth, conduit shall be installed not less than 6” below existing grade.
11. Verify that information concerning finish grade is accurate, for should the underground run be less than the specified depth, Contractor may be required to re-install conduit to meet the required depth.
12. Unless otherwise specified, underground conduits shall be installed with top side not less than 24” below finished grade; this depth applies to all conduits outside of building foundations including those under walks, open corridors or paved areas.
13. Utility company service conduits installation depth shall be as directed by their respective specifications and requirements.

B. Boxes

1. Before locating outlet boxes, check Construction Documents for type of construction and make sure that there is no conflict with other equipment. Locate outlet boxes as shown and locate so as not to interfere with other Work or equipment.
2. Install all outlet boxes flush within walls, ceiling and floors except where installed within non-finished rooms, cabinetry, attic spaces or as indicated on Drawings.
3. Locate pull boxes and junction boxes within concealed, accessible locations where possible.
4. Do not install outlet boxes back-to-back with same stud space. Where shown back-to-back, offset as required, and fill void with sound dampening material where requested by Owner.
5. In fire rated walls separate boxes by 24” minimum and with stud member.
6. Adjust position of outlet boxes within masonry wall to accommodate course lines.

3.03 INSTALLATION

A. Conduit

1. Minimum conduit size shall be 3/4” unless otherwise indicated.
2. All conduit work shall be concealed unless otherwise indicated. Exposed conduits shall be permitted within unfinished rooms/spaces to facilitate installation.
3. Install conduit in complete runs prior to installing conductors or cables.
4. Make long radius conduits bends free from kink, indentations or flattened surfaces. Make bends carefully to avoid injury or flattening. Bends 1 1/4” size and larger shall be factory made ells, or be made with a manufactured

mechanical bender. Heating of steel conduit to facilitate bending or that damage galvanized coating will not be permitted.

5. Remove burrs and sharp edges at end of conduit with tapered reamer.
6. Protect and cover conduits during construction with metallic bushings and bushing “pennies” to seal exposed openings.
7. Assemble conduit threads with anti-corrosion, conductive, anti-seize compound and tighten securely.
8. Install conduits shall that no traps to collect condensation exist.
9. Fasten conduit securely to boxes with locknuts and bushings to provide good grounding continuity.
10. Install pull cords/line within any spare or unused conduits of sufficient length to facilitate future cable installation.
11. Penetrations
    a. Locate penetrations within structural members as shown on Drawings and as directed by Architect or Engineer. Should it be necessary to notch any framing member, make such notching only at locations and in a manner as approved by Engineer.
    b. Do not chase concrete or masonry to install conduit unless specifically approved by Engineer.
    c. Cutting or holes
        1) Install sleeves for cast-in-place concrete floors and walls. After installing conduit through penetration, seal using dry-pack grouting compound (non-iron bearing, chloride free and non-shrinking) or fire rated assembly if rated floor or wall. Use escutcheon plate on floor underside to contain compound as necessary.
        2) Cut holes with a hole saw for penetrations through non-concrete or non-masonry members.
        3) Provide chrome plated escutcheon plates at all publicly exposed wall, ceiling and floor penetrations.
    d. Sealing
        1) Non-rated penetration openings shall be packed with non-flammable insulating material and sealed with gypsum wallboard taping compound.
        2) Fire rated penetration shall be sealed using a UL classified fire stop assembly suitable to maintain the equivalent fire rating prior to the penetration.
        3) Use escutcheon plates to hold sealing or fire rated compound as necessary.
    e. Waterproofing
        1) Make penetrations through any damp-proofed/waterproofed surfaces within damp/wet locations as such as to maintain integrity of surface.

2) Install specified watertight conduit entrance seals at all below grade wall and floor penetrations.

3) At roof penetrations furnish roof flashing, counter flashing and pitch-pockets compatible to roof assembly.

4) Where possible conduits that horizontally penetrate a waterproof membrane shall fall away from and below the penetration's exterior side.

5) Make penetrations through floors watertight with mastic, even when concealed within walls or furred spaces.

12. Supports

a. Conduits shall be support and braced per OSHPD pre-approved anchorage systems when those methods are implemented and installed.

b. Sizes of rods and cross channels shall be capable of supporting 4 times and 5 times actual load, respectively. Anchorage shall support the combined weight of conduit, hanger and conductors.

c. Support individual horizontal conduit 1 1/2" and smaller by means of 2 hole straps or individual hangers.

d. Galvanized iron hanger rods sizes 1/4" diameter and larger with spring steel fasteners, clips or clamps specifically design for that purpose for 1 1/2" conduits and larger.

e. Support multi-parallel horizontal conduits runs with trapeze type hangers consisting of 2 or more steel hanger rods, preformed cross channels, 'J' bolts, clamps, etc.

f. Support conduit to wood structures by means of bolts or lag screws in shear, to concrete by means of insert or expansion bolts and to brickwork by means of expansion bolts.

g. Support multi-parallel vertical conduits runs with galvanized Unistrut, Power-Strut or approved equal type supports anchored to wall. Where multi-floored conduits pass through floors, install riser clamps at each floor.

h. Maximum conduit support spacing shall be in accordance with NECA Standard of Installation:

1) Horizontal runs:

a) 3/4" and smaller at 60" on centers, unless building construction prohibits otherwise, then 84" on centers.

b) 1" and larger at 72" on centers, unless building construction prohibits otherwise or any other condition, then 120" on centers.

2) Vertical runs:

a) 3/4" and smaller @ 84" on centers.

b) 1" and 1 1/4" @ 96" on centers.

c) 1 1/2" and larger @ 120" on centers.

d) Any vertical condition such as shaftways and concealed locations for any sized conduit, 120" on centers.

i. Anchorage for RMC/IMC supports unless otherwise specified:

1) < 1” IMC/RMC = #10 bolt/screw.

2) 1” IMC/RMC = 1/4” bolt/screw.

3) 1 1/2” and 2” IMC/RMC = 3/8” bolt/screw.

4) 3” IMC/RMC, 4” EMT = 1/2” bolt/screw.

5) > 3” IMC/RMC = 5/8” bolt/screw.

j. Anchorage for EMT supports unless otherwise specified:

1) < 1 1/2” EMT = #10 bolt/screw.

2) 1 1/2” EMT = 1/4” bolt/screw.

3) 2, 2 1/2” and 3” EMT = 3/8” bolt/screw.

4) 4” EMT = 1/2” bolt/screw.

5) > 4” EMT = 5/8” bolt/screw.

B. Boxes

1. Install boxes as shown on Drawings and as required for splices, taps, wire pulling, equipment connections and Code compliance.
2. Install additional pull boxes, not shown on Drawings, in sufficient quantities to facilitate pulling of conductors and cables such that total spacing does not exceed 150 feet or 270 degrees, total; and maximum pulling tension will not be exceeded.
3. Install plaster rings on all outlet boxes in stud walls or in furred, suspended or exposed ceilings. Covers shall be of a depth suited for installation.
4. Provide gasketed cast metal cover plates where boxes are exposed in damp or wet locations
5. Install access door for boxes installed within concealed locations without access.
6. Install approved factory made knockout seal where knockouts are not present.
7. Refer to Architectural interior elevations and details shown for exact mounting heights of all electrical outlets. In general, locate outlets as shown or specific and complies with Americans with Disabilities Act:
   a. Convenience outlets: +18”AFF or +6” above counter or splash.
   b. Local switches: +48”AFF or +6” above counter or splash.
   c. Telecommunication outlets: +18”AFF or +48”AFF for wall telephone or intercom device.
   d. Verify all mounting heights with Architectural Drawings, and where heights are not suited for construction or finish please consult Engineer or Architect.
8. Use conduit bodies to facilitate pulling of conductor or cables or change conduit direction. Do not splice within conduit bodies.
9. Enclose pull box with additional rated gypsum board as necessary to maintain wall’s original fire rating.

10. Install galvanized steel coverplates on all open boxes within dry listed areas.
11. Install in-ground pull holes/boxes flush to grade finish at finished areas or 1" above finished landscaped grade. Seal all conduits terminating in pull hole/box watertight. Install and grout around bell ends where shown. Cover and lids shall be removable without damage to adjacent finish surfaces.
12. Support
    a. Accurately place boxes for finish, independently and securely supported by adequate blocking or manufacturer channel type heavy-duty box hangers for stud walls. Do not use nails to support boxes.
    b. Support boxes independent of conduit system.
    c. Mount boxes installed within ceilings to 16 gauge metal channel bars attached to main runners or joists.
    d. Support boxes within suspended acoustical tile ceilings directly from structure above when light fixture are to be installed from box.
    e. Use auxiliary plates, bar or clips and grouted in place for masonry, block or pour-in-place concrete construction.

3.04 APPLICATION

A. Conduit
    1. RMC/IMC suitable for all damp, dry and wet locations except when in contact with earth. IMC not suitable for hazardous locations as stated within CEC/NEC.
    2. CRMC suitable for damp or wet locations, concealed within concrete or in contact with earth.
    3. EMT suitable for exposed or concealed dry, interior locations.
    4. PVC/RTRC suitable for beneath ground floor slab, except when penetrating, and direct earth burial. Do not run exposed within concrete walls or in floor slab unless indicated on Drawings or per Engineer's permission.
    5. FMC suitable for dry locations only for connections to motors, transformers, vibrating equipment/machinery, controllers, valves, switches and light fixtures in less than 6 foot lengths.
    6. LFMC application same as FMC above but for damp or wet locations.
B. Termination and joints
    1. Use raceway fittings compatible with associated raceway and suitable for the location.
    2. Raceways shall be joined using specified couplings or transitions where dissimilar raceway systems are joined.
    3. Conduits shall be securely fastened to cabinets, boxes and gutters using (2) two locknuts and insulating bushing or specified insulated connector. Where joints cannot be made tight and terminations are subject to vibration, use bonding jumpers, bonding bushings or wedges to provide electrical continuity of the raceway system. Use insulating bushings to protect conductors where subjected

to vibration or dampness. Install grounding bushings or bonding jumpers on all conduits terminating at concentric or eccentric knockouts.

4. Terminations exposed at weatherproof enclosures and cast outlet boxes shall be made watertight using specified connectors and hubs.
5. Stub freestanding equipment conduits through concrete floors for connections with top of coupling set flush with finished floor. Install plugs to protect threads and entrance of debris.
6. Install specified cable sealing bushings on all conduits originating outside the building walls and terminating within interior switchboard, panel, cabinet or gutters. Install cable sealing bushings or raceway seal for conduit terminations in all grade level or below grade exterior pull, junction or outlet boxes.
7. Where conduits enter building from below grade inject into filled raceways pre-formulated rigid 2 lbs. density polyurethane foam suitable for sealing against water, moisture, insects and rodents.
8. Install expansion fitting or expansion/deflection couplings per manufacturer's recommendations where:
    a. Any conduit that crosses a building structure expansion joint; secure conduit on both sides to building structure and install expansion fitting at joint.
    b. Any conduit that crosses a concrete expansion joint; install expansion/deflection at joint.
    c. Any conduit greater than 1-1/4" is routed along roof top in runs greater than 100 feet; install expansion fittings every 100 feet.
    d. Engineer may allow FMC or LFMC in lieu of expansion fitting or expansion/deflection couplings on conduits 2" and smaller within accessible locations upon further review and written consent.

C. Boxes

1. Standard type suitable for all flush installations and all dry concealed locations.
2. Concrete type suitable for all flush concrete installations.
3. Masonry type suitable for all flush concrete and block installations.
4. Surface cast meta type suitable for all exposed damp and wet surface mounted locations, and dry surface mounted locations less than 96" from finished floor

END OF SECTION

SECTION 27 15 13 – COPPER TELECOMMUNICATIONS/DATA CABLING AND DEVICES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes

1. Provide all labor, materials and equipment necessary to complete the installation required for the items specified under this Section, including but not limited to copper data communication cabling systems and copper based telecommunication, which include.

a. Category 6 cabling

1) Provide scheduled station plates at each indicated location. Provide labeled Category 6 modules in the plates, and document per Specifications.

2) Homerun all station cabling from each universal Category 6 data jack to the indicated MDF or IDF.

3) Provide Category 6 patch panels where indicated. Terminate and test Category 6 cabling as detailed within the Specifications.

4) Terminate, test and document Category 5E cabling as detailed within the Specifications.

b. Category 3, RUS (REA) and USOC telephone cabling

1) Provide scheduled station plates at each indicated location.

2) Homerun all station cabling from each telephone jack to indicated cabinet/telephone backboard.

3) Provide punch blocks as necessary; terminate and test as detailed within the Specifications.

B. Related sections

1. Where items specified in other Division 27 sections conflict with the requirements of this Section, the most stringent requirement shall govern.

a. 27 05 26 – Grounding and Bonding for Communications

b. 27 11 16 – Data Racks and Enclosures

c. 27 05 28 – Pathways for Communication System

2. The requirements of this Section apply to all Division 27 work, as applicable.

3. Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.

1.02 REFERENCES

A. Comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified:

1. ANSI –American National Standards Institute
    a. ISO/IEC 11801; Information technology - Generic cabling for customer premises
2. CCR –California Code of Regulations, Title 24
    a. Part 3 -California Electrical Code(CEC); NFPA 70 National Electrical Code (NEC) with California amendments
3. CFR –Code of Federal Regulations
    a. Title 7 –Agriculture, Part 1755 – Telecommunications Standards and Specifications for Materials, Equipment and Construction
    b. Title 47 –Telecommunication, Part 68 – Connection of Terminal Equipment to the Telephone Network.
4. TIA/EIA – Telecommunications Industry Association/Electronic Industries Alliance
    a. Wiring/Cabling Standards
        1) TIA/EIA-568-B.1; Commercial Building Telecommunications Cabling Standard - Part 1: General Requirements
        2) TIA/EIA-568-B.2; Commercial Building Telecommunications Cabling Standard - Part 2: Balanced Twisted Pair Cabling Components
        3) TIA/EIA-569-A; Commercial Building Standards for Telecommunications Pathways and Spaces
        4) TIA/EIA-606; Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
        5) TIA/EIA/IS-729; Technical Specifications for 100 Ohm Screened Twisted-Pair Cabling
        6) TIA/EIA-758; Customer Owned Outside Plant Telecommunications Cabling Standard
        7) TSB67; Transmission Performance Specifications for Field Testing of Unshielded Twisted-Pair Cabling Systems
        8) TSB95; Additional Transmission Performance Guidelines for 4-Pair 100 Category 5 Cabling
5. ICEA –Insulated Cable Engineers Association
    a. S-56-434; Polyolefin Insulated Communications Cables for Outdoor Use
    b. S-80-576; Category 1 & 2 Individually Unshielded Twisted Pair Indoor Cables for Use in Communications Wiring Systems
    c. S-90-661; Category 3, 5, & 5e Individually Unshielded Twisted Pair Indoor Cable for Use in General Purpose and LAN Communication Wiring Systems
    d. S-101-699; Standard for Category 3 Individually Unshielded Twisted Pair Indoor Cable for Use in General Purpose Non-Lan Telecommunication Wiring Systems

6. IEEE –Institute of Electrical and Electronic Engineers
   a. C2; National Electrical Safety Code (NESC)
   b. 802.3; Information Technology -Local and Metropolitan Area Networks
   c. 820; Standard Telephone Loop Performance Characteristics
7. NECA –National Electrical Contractors Association
   a. NECA/BICSI 568; Standard for Installing Commercial Building Telecommunications Systems
8. UL –Underwriters Laboratories, Inc.
   a. 444; Communications Cables
   b. 497; Standard for Protectors for Paired-Conductor Communications Circuits
   c. 1581; Reference Standard for Electrical Wires, Cables, and Flexible Cords
   d. 1666; Standard Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts
   e. 1685; Standard for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables
   f. 1863; Standard for Communications-Circuit Accessories
9. U.S. Department of Agriculture, Rural Utilities Service (RUS), formerly Rural Electrification Administration (REA) Standards
   a. PC-2; Splicing Plastic Insulated Cables
   b. PC-4; Acceptance Tests and Measurements of Telephone Plant
   c. PE-22; Aerial and Underground Telephone Cable
   d. PE-33; Shield Bonding Connectors
   e. PE-39; Filled Telephone Cables
   f. PE-52; Telephone Cable Splicing Connectors
   g. PE-60; Trunk Carrier Systems
   h. PE-74; Filled Splice Closures
   i. PE-87; Terminating (TIP) Cable
   j. PE-89; Filled Telephone Cable with Expanded Insulation
   k. TE&CM Section 644; Design and Construction of Underground Cable

1.03 SYSTEM PERFORMANCE STANRDARDS

A. Voice copper plant
   1. To Universal Service Ordering Code (USOC) Standards (CFR Title 47, Part 68, Subpart F, Section 68.502) and other appropriate authorities.
   2. Where voice plant cabling is specified for connection to RJ-11 or RJ-14 jacks conform to USOC and Category 3 standards as demonstrated using the appropriate test equipment.

B. Category 6 copper cabling plant:

1. To applicable EIA/TIA standards using a digital cable analyzer as specified herein.

1.04 SUBMITTALS

A. Submit manufacturer's data for materials specified within this Section in accordance to Section 26 05 00.

1.05 QUALITY ASSURANCE

A. All materials, equipment and parts comprising the materials specified herein shall be new and unused, bearing UL labels where applicable.

B. Installer Qualifications

1. The work performed under this Section shall be certified by the manufacturer of the equipment and components being furnished and be authorized by the manufacturer to install and convey the product warranty and performance guarantee to the Owner upon completion of Contract.

2. Installing Contractor must have a minimum of three years previous experience in data communications and/or telecommunication systems installation. All Contractors and/or Vendors supplying all or parts of the work described herein shall supply three project references within the Submittal package at the Engineer's request, which substantiate the Contractor/Vendors' previous experience as noted herein.

C. Testing Equipment

1. Furnish in conformance with the applicable requirements of this Section.

2. Test systems using at least one each of the following test measurement devices or approved functional equivalents:

a. Digital cable analyzer with applicable copper and/or fiber testing standards required within this Section.

b. Cabling plant tester capable of detecting shorts, opens, reversals and miswires.

c. Tone test set capable of analyzing line condition of voice lines.

d. Any other items of equipment or materials required to demonstrate conformance with the Contract Documents.

1.06 DELIVERY, STORAGE AND HANDLING

A. Wire shall be in original unbroken package. Obtain approval of Inspector or Engineer before installation of wires.

B. Handle carefully to avoid damage to internal components, enclosure and finish.

C. Store in a clean, dry environment. Maintain factory packaging and, if required, provide an additional cover to protect enclosure in harsh environments.

1.07 WARRANTY

A. Furnish guarantee in accordance with and in form required under Section 26 05 00.

B. Provide 15 year manufacturer's warranty covering application assurance, product, cable, and labor for installations performed by a certified installer using the manufacturer's connecting hardware and qualified cables.

PART 2 - PRODUCTS

2.01 DATA/VOICE CATEGORY-6 RATED COPPER CABLES

A. General

1. Exceeds EIA/TIA-568 Category 6 requirements and tested to 300Mhz.
2. Conductors shall be no small than 24AWG solid annealed bare copper.
3. Outdoor, underground cables must be UL listed for wet applications.
4. Cabling construction and use shall comply with CEC Article 800.

B. Indoor, General (Type CM/CMG/CMR/CMP)

1. Drawing Reference: UTP6-4
2. Cables installed within vertical shafts or risers shall be Type CMR or CMP listed.
3. Construction: Thermoplastic insulated 8 conductor (4 pair) assembly with flame retardant PVC jacket.
4. Manufacturer: Commscope UltraMedia, Mohawk AdvanceNet, Superior Essex NetGain or approved equal.

C. Indoor, Plenum (Type CMP)

1. Drawing Reference: UTP6-4P
2. Construction: FEP/PE insulated 8 conductor (4 pair) assembly with low smoke PVC/FEP jacket.
3. Manufacturer: Commscope UltraMedia, Mohawk AdvanceNet, Superior Essex NetGain or approved equal.

D. Outdoor, Underground

1. Drawing Reference: UTP6-4OP
2. Construction: FEP/PE insulated 8 conductor (4 pair) assembly with floodant compound and PE jacket.
3. Manufacturer: Mohawk AdvanceNet or approved equal.

E. Indoor, Shielded (Type CM/CMG/CMR/CMP)

1. Drawing Reference: STP6-4
2. Construction: FEP/PE insulated 8 conductor (4 pair) with an overall tape/drain shield and flame retardant PVC or low smoke PVC/FEP jacket.

3. Manufacturer: Mohawk AdvanceNet or approved equal.

F. Outdoor, Underground Shielded

1. Drawing Reference: STP6-4OP
2. Construction: PE/PVC insulated 8 conductor (4 pair) with an overall tape/drain shield, floodant compound and PE/PVC jacket.
3. Manufacturer: Mohawk AdvanceNet or approved equal.

2.02 TELEPHONE PLANT COPPER CABLES

A. General

1. Cables which interconnect interior distribution centers and terminate at station jacks shall conform to ICEA S-80-576, Category 1 or Category 3 standards.
2. Conductors shall be 22AWG solid annealed bare copper with minimum pair counts indicated on the plans.
3. Outdoor, underground cables must be UL listed for wet applications.
4. Cabling construction and use shall comply with CEC Article 800.

B. Indoor, General (Type CM/CMG/CMR/CMP)

1. Drawing Reference: UTP-##, where ## refers to required pair count
2. Cables installed within vertical shafts or risers shall be Type CMR or CMP listed.
3. Construction: Thermoplastic insulated conductors situated as paired assemblies with a flame retardant PVC jacket.
4. Manufacturer: Belden, Mohawk or approved equal.

C. Indoor, Plenum (Type CMP)

1. Drawing Reference: UTP-##P, where ## refers to required pair count
2. Construction: FEP/PE insulated conductors situated as paired assemblies with a low smoke PVC/FEP jacket
3. Manufacturer: Belden, Mohawk or approved equal.

D. Outdoor, Underground Within Duct

1. Less than (≤) 4 pair trunk cables
   a. Drawing Reference: STP-##OP, where ## refers to required pair count
   b. Construction: Polyolefin, PE or PVC insulated conductors situated as paired assemblies with a foil shield, floodant compound and PE jacket.
   c. Manufacturer: Belden, Westpenn Aquaseal or approved equal.
2. Greater than (>) 4 pair trunk cables
   a. Drawing Reference: STP-##OP, where ## refers to required pair count
   b. Construction:
      1) Shall be RUS (REA) PE-89 listed, and suitable for direct burial.
      2) PE jacket with aluminum tape shield and flooded core assembly.

3) The core assembly shall consist of twisted pair cables with polyolefin insulation.

c. Manufacturer: General Cable, Superior Essex SEALPIC-FSF or approved equal.

2.03 DATA/VOICE STATION JACKS & MODULES

A. General Jack and Module Requirements

1. Meets or exceeds the following configuration and performance standards where applicable:
   a. EIA/TIA 568B
   b. ISO/IEC 11801, Class E
   c. UL1863
   d. CEC/NEC Article 800
   e. FCC Part 68
2. High impact, flame retardant thermoplastic.
3. Integral locking mechanism upon insertion of a modular plug.

B. Voice jack USOC grade

1. Six (6) position, RJ25 configuration jack conforming to USOC requirements.
2. Manufacturers
   a. Leviton, Siemon or approved equal.

C. Voice and/or data jack, Category 3

1. Eight (8) position, RJ45 configuration jack conforming to EIA/TIA 568B and USOC requirements.
2. Manufacturers
   a. Leviton, Siemon or approved equal.

D. Data jack Category 6

1. Eight (8) position, RJ45 configuration jack conforming to EIA/TIA 568B requirements.
2. Manufacturers
   a. Leviton eXetreme, Siemon Ultra Max or approved equal.

2.04 TELECOMMUNICATION STATION PLATES

A. Modular plates

1. Construction
   a. Modular, with snap-in receptacle options as scheduled.
   b. Single gang plate size and mounting.
   c. Options for 1 to 6 modular jacks per plate.

d. Plate face shall be nylon; color shall be compatible with adjacent wall finish, unless otherwise indicated.

e. Integral labeling provided for plate identifier and identifier for each receptacle on the plate. Provide as follows:

1) Plate nominally 1-½" by ½" recessed slot with clear plastic cover over paper label. See labeling requirements in Part 3 of this Section.

2) Receptacle identifier(s) shall be iconic or literal descriptions of each receptacle type.

f. System shall provide at minimum the following receptacle options:

1) RJ45 Category 3 or RJ25 voice

2) RJ45 Category 6 data

3) 75Ω BNC

4) 75ΩF

5) Phono (RCA) type

6) ST fiber adapter

7) SC fiber adapter

8) S video

9) Blank plate fillers as required to fill unused area.

2. Manufacturers

a. Leviton QuickPort MOS, Siemons CT or approved equal

B. Wall phones plates (non-VOIP or Category-6 jack type)

1. Construction

a. Single gang plate size and mounting.

b. Plate face shall be stainless steel with 2 mounting stud type screws for mounting of telephone handset; unless otherwise indicated.

c. Jack shall be USOC voice grade as described above.

2.05 CABLE TERMINATION EQUIPMENT AND RELATED, CATEGORY RATED

A. Data Patch Panels, Category 6 Rated, Rack Mounted

1. Drawing Reference: ##C6PP, where ## refers to port count.

2. Functions/Features

a. 19" EIA rack mountable.

b. 24 ports per one (1) EIA rack unit (1.75") minimum, unless otherwise noted on Drawings.

c. Keyed, block form RJ-45/Category 6 jacks and 110 terminations meeting specifications elsewhere herein.

1) Arranged in rows on steel panel.

2) Jacks on front and terminations on rear.

d. Port identifier label space on front.

e. Provide wire management rings in a ratio of at least 4 rings for every 24 ports.

3. Manufacturers

a. Leviton, Siemon or approved equal.

B. Category 3 Terminal Block with Pre-Wired RJ21C Connector

1. Drawing reference: 110PWTB##, where ## refers to pair count.

2. Features/Functions

a. Type 110 terminal block with pre-wired RJ21C 50 pin connector on block or on end of pigtail stub cable.

b. Meets Category 3 specifications.

3. Manufacturers

a. Siemon S110A series, Siemon S700 or approved equal.

C. Category 3 Rack Mount Patch Panels with Pre-Wired RJ21C Connector

1. Drawing reference: ##110PWC3PP, where ## designates port count.

2. Features/Functions/Construction

a. 19” EIA rack mount panel.

b. Front face: RJ45 jacks

c. Rear face: Pre-wired RJ21C 50 pin connector(s).

d. Printed Circuit board linking RJ45’s to RJ21C – all four pairs wired straight through.

e. Meets Category 3.

f. At least 24 Jacks per rack unit (RU).

3. Manufacturers

a. Siemon, Signamax or approved equal.

2.06 MISCELLANOUS DEVICES

A. Shield Connectors

1. Shield connectors shall make a stable, low-impedance electrical connection between the shield of the communications cable and a conductor such as a strap, bar or wire.

2. The connector shall be made of tin-plated tempered brass.

3. RUS PE-33 compliant.

4. Manufacturers

a. Preformed Line Products Servi-Bond or approved equal.

B. Grounding Braid

1. Ground braid shall provide low electrical impedance connections for dependable shield bonding.
2. The braid shall be made from 1/2” wide flat tin-plated copper, length as required.
3. Provide eyelets as necessary for bonding purposes.
4. Manufacturers
   a. Thomas Betts, 3M or approved equal.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that all raceways have been de-burred and properly joined, coupled, and terminated prior to installation of cables. Verify that all raceways are clear of foreign matter and substances prior to installation of wire or cable.

B. Inspect all conduit bends to verify proper radius. Comply with Code and cable manufacturer requirements for minimum permissible radius and maximum permissible deformation.

3.02 INSTALLATION

A. Separation of Wires: Comply with EIA/TIA-569 rules and CEC/NEC 800-52 for separation of unshielded copper voice and data system cables from potential EMI sources, including electrical power lines and equipment.

B. All necessary interconnections, services, and adjustments required for a complete and operable system shall be provided. All installation work must be done in accordance with the safety requirements set forth in the general requirements of IEEE C2 and CEC/NEC 800.

C. Unless otherwise noted, all trunk and backbone cables and conductors shall have surge and ground protection installed at each end which meets RUS PE-60 requirements. Refer to requirements herein and within the referencing Section as to the acceptable products in each application.

D. Wire and cable installation:

1. All wire and cable shall be continuous and splice-free for the entire length of run between designated connections or terminations.
2. At designated splices, maintain conductor color code across all splices.
3. Copper conductor voice cable outside plant splicing shall be accomplished in accordance with RUS PC-2.
4. All shielded cables shall be insulated. Do not permit shields to contact conduit, raceway, boxes, panels or equipment enclosures.
5. Within buildings, make splices only in designated terminal cabinets and/or on designated equipment backboards.

6. Outdoor splices shall not be permitted except where specifically noted or where required by the run length. Where run lengths require outdoor splices not noted on the drawings, notify Engineer in writing for direction before proceeding.
7. Do not subject wire and cable to tension greater than that recommended by the cable manufacturer. Use multi-spool rollers where cable is pulled in place around bends. Do not pull reverse bends.
8. Provide a box loop for all wire and cable routed through junction boxes or distribution panels. Provide tool formed thermal expansion loops at cable at manholes, handholes and at both sides of all fixed mounted equipment. Cable loops and bends shall not be bent at a radius greater than that recommended by the manufacturer.
9. Secure all wire and cable run vertically for continuous distances greater than thirty (30) feet. Secure robust non-coaxial cables with screw-flange nylon cable ties, kellem grip or similar approved devices appropriate to weight of cable. For all other cables, provide symmetrical conforming nonmetallic bushings or woven cable grips appropriate to weight of cable.
10. Where drawings specifically permit use of exposed cable installation in Plenum and/or Suspended Ceiling voids, conform to the following:
    a. Conform to EIA/TIA 569 with respect to separation from power and radio frequency (RF) sources. Provide at least twice the listed separation at fluorescent light fixtures, ballasts and similar high intensity EMF sources (including but not limited to motors, transformers and copiers).
    b. Support: Provide support for all cabling. Do not place or attach directly to T-bar grid, concealed spline grid, flexible or rigid ductwork, HVAC registers, sprinkler piping or fixtures, light fixtures.
        1) Provide supports at least 48” on center, with cables installed with slight sag to ensure conformance with EIA TSB40 tensioning and stress limits.
    c. Placement: Do not obscure access to access doors, hatches, air dampers, valves, cable trays, junction boxes, pull boxes or similar areas of access.
    d. Place EMT pipe sleeves at all wall penetrations. Fire stop sleeves and cables where penetrating a rated wall with an approved UL assembly.
11. Wiring practices
    a. Land all non-coaxial field wiring entering each equipment rack at specified terminal devices prior to connection to any equipment or devices within racks. At Contractor’s option and at no additional costs to Owner, such terminals may be located in the equipment racks or in the terminal cabinets provided.
    b. Apply all crimp connectors only with manufacturer’s recommended ratchet type tooling and correct crimp dies for connector and wire size; pliers type crimp tooling shall not be acceptable.
    c. Coordinate insulation displacement (quick connect) terminal devices with wire size and type. Comply with manufacturer’s recommendations, and make connections with automatic impact type tooling set to a recommended force.

d. Make all connections to screw-type barrier blocks with insulated cirmp-type spade lugs. Lugs are not required at captive compression terminal type blocks. Provide permanent designation strips designed for use with the terminal blocks provided. Make neat, intelligible markings with indelible markers equivalent to “Sharpie”.

e. Tin terminated shield drain wires and insulate with heat shrinkable tubing.

f. Use only rosin core 60/40 tin/lead solder for all solder connections.

g. Dress, lace or harness all wire and cable to prevent mechanical stress on electrical connections. No wire or cable shall be supported by a connection point. Provide service loops where harness of different classes cross or where hinged panels are to be interconnected.

h. Termination and build-out resistors and related circuit correction components shall be visible. Do not install in connector shells or internally modify equipment. Show locations on Record Drawings.

i. Correct any and all of the following unacceptable wiring conditions:

1) Deformed, brittle or cracked insulation.

2) Torn or worn cable jacket.

3) Excessively scored cable jackets

4) Insulation shrunken or stripped further than 1/8” away from the actual point of connection within a connector, or on a punch block.

5) Cold solder joints.

6) Flux joints.

7) Solder splatter.

8) Ungrommeted, unbushed, or uninsulated wire or cable entries.

9) Deformation or improper radius of wire or cable.

12. Data cabling wiring practice (For copper cabling used in circuits of >1.0 Mbps conform to the following, in addition to the general requirements above.)

a. Limit cable bends to a minimum radius of eight (8) times cable diameter except where otherwise noted herein.

b. At junction boxes, form circular radius bends of eight times cable diameter minimum. Up to two (2) flat bends of 90° or less are permitted in any single cable run where necessary to accommodate field wiring conditions. Flat bends exceeding 90° will not be accepted.

c. At the receptacle, a single bend of 90° or less and a 1 inch radius shall be permitted subject to the cable manufacturer certification of such an installation meeting Category 5E requirements. Contractor to field verify the performance of the proposed installation in a mockup using the proposed cabling, jacks, raceway and listed test equipment prior to proceeding.

d. Tie wraps to be hand (not tool) tightened.

e. Total run not to exceed 92 meters (300 feet). If condition exists report exceeded requirements to Engineer.

13. Labeling

    a. Provide permanent identification of run destination at all raceway terminations. Identify at each manhole, vault, handhole, terminal cabinet, pull box, equipment rack and receptacle/outlet.

    b. Unless otherwise noted, conform to the standards and methods of EIA/TIA 606.

    c. Identify all wire and cable clearly with permanent labels rapped about the full circumference within one (1) inch of each connection. Provide any of the following:

        1) Continuous permanent imprint; equivalent to Clifford of Vermont, Inc. “Quick-Pull”.

        2) Direct hot stamp.

        3) Heat shrinkable factory hot stamped; equivalent to Bradysleeve Heatshrink.

        4) Adhesive strip printed labels wrapped the full circumference of the wire and sealed with clear heat shrink tubing; equivalent to Thomas Betts or Panduit Insta-code with clear heat-shrunk tubing equivalent to Alpha.

        5) Outside Plant, in Manholes or Pull Boxes. Panduit Fiber Optic Cable Marker Tags (Type PST-FO) or Lead tags, 2” square, drilled for cable attachment. Use cable ties or THWN #12 or 2 #14 wrapped twice around the cable bundle and secure to tag using a crimp fastener.

    d. Indicate:

        1) Indicate the number designated on the associated field or shop drawing or run sheet, as applies. Assign wire or cable designations consistently throughout a given system. Each wire or cable shall carry the same labeled designation over its entire run, regardless of intermediate terminations.

        2) Indicate installation date.

    e. Terminal cabinet, pull box and manhole, handhole, vault or similar locations subject to abuse, label in accordance to Section 26 05 00.

        1) Patching Bays and Jacks and Receptacles containing six or fewer jacks/outlets: Provide designation strip holders with clear plastic covers to retain replaceable designation strips. Provide designation strips with block lettering on permanent background in contrasting color. Use photographic print, laser print on acid free paper, plotting ink on Mylar, or equivalent non-fading process. Alternatively, provide black on white adhesive labels equivalent to those produced by Brother brand P-Touch Letter Machine. Embossed plastic (Dymo) labels shall not be acceptable. The presence of manufacturer provided silk screen iconic identification labels shall not relieve the contractor from the requirement to identify the receptacle with its associated cabling and circuit.

14. Signal grounding procedures
    a. Where items specified in Section 28 05 26 conflict with the requirements of this Section, the most stringent requirement shall govern.
    b. Equipment enclosures shall not be permitted to touch each other unless bolted together and electrically bonded.
    c. Ground and bond equipment racks and similar equipment enclosures containing powered equipment exclusively to a telecommunication grounding bus bar.
    d. At each rack, provide a lug bonded to the rack frame with a #10 Cu THWN stranded wire to the rack isolated ground bus.
    e. Equipment signal ground shall be to racks isolated ground bus via the green wire of the equipment power cord. Where equipment uses an ungrounded power cord, provide #12 green bond wire to rack isolated ground bus bar. At equipment housing, provide crimp lug and suitable hardware for bonding.
    f. Shielded cables of this section shall be grounded exclusively to a telecommunication grounding bus bar by a single path. Shield shall be tied to ground bar at one end only, i.e., at the low potential (receiving) end of run, unless otherwise noted.

3.03 FIELD QUALITY CONTROL

A. General
    1. Test and report on each intermediate cabling segment separately, including station cabling, horizontal distribution (each segment, if multiple) and telecommunications closet wiring.
    2. Test each end to end cable link.
    3. Submit copy of final results on paper and in machine readable form, organized by circuit number, consistent with circuit numbering scheme used in preparing submittal drawings and in labeling receptacles and terminations.
        a. Submit machine-generated documentation and raw data of all test results on Contractor-provided, Owner approved forms; and in electronic format approved by the Owner.
        b. Where the machine-generated documentation requires use of a proprietary computer program to view the data, provide the Owner with 1 licensed copy of the software.
        c. Provide registered testing software used for the actual tests to the Owner/Engineer for review of test data as may be required.

B. Station Wiring, General
    1. Test station wire only after all pairs of station wire in a work area have been terminated at both ends, and no work of this Section or other Sections may cause physical disturbance to the wiring.
    2. Correct any and all transpositions found, and retest.

3. If any conductor in a station wire tests either open or short, then the entire station wire is to be removed, replaced and retested.

C. Inside Cabling

1. Using a listed Category 6 cable test set, test and submit report on the parameters specified. Report whether tested link passes or fails the Category 5E standards outline within EIA/TIA-568.

2. Note exceptions to required Category standards. Remedy and retest.

D. Telephone: Outside Plant, Inside Riser Wire, Voice Station Wire (where not Category rated):

1. General

a. A new cable shall be tested only after all wires within the cable have been terminated at both ends.

b. For unshielded cable, “measurements to ground” means an electrical connection to the Telecommunications Ground Bus, building steel, electrical metallic conduit or a water pipe.

c. The Contractor shall correct all defects possible.

d. If the maximum number of un-repairable defective pairs exceeds 4% of the cable’s pair count, the cable shall be deemed unacceptable and shall be replaced. Replace, re-terminate and retest new cable at no additional cost to the Owner.

2. Test procedures

a. Test #1 – Continuity:

1) Meter set for 20Ω full scale ohm reading. Each pair shall be shorted at one end and the loop resistance value read at the other.

2) The difference between the largest and the smallest resistance reading from each pair in the cable shall be no more than 10 percent of the largest reading.

b. Test #2 – Balance, Polarity and Conductor Transpositions:

1) Upon passing Test #1, the tester at one end of cable shall ground tip side of each pair in turn. The tester at other end of cable reads resistance to building ground of same conductor.

2) Reading for each tip conductor in pair of approximately on-half of loop resistance value from Test #1.

3. Test Report

a. Submit Test Report. Documentation shall include loop resistance regarding any opens, shorts, transpositions as well as corrective actions.

END OF SECTION

SECTION 31 23 17 – TRENCHING, BACKFILLING & COMPACTING

PART 1. GENERAL

1.01 SUMMARY

A. Section Includes:

1. Excavating trenches for utilities
2. Shoring and Sheeting
3. Backfilling and compaction

1.02 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO):

AASHTO T180:	Standard Specification for Moisture-Density Relations of Soils Using a 454-kg (10-lb) Rammer and a 457-mm (18-in) Drop
AASHTO M43:	Standard Sizes of Coarse Aggregate for Highway Construction

B. American Society for Testing and Materials-International (ASTM):

ASTM D698:	Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort [12,400 ft-lbf/ft^3 (600 kN-m/m^3)]
ASTM D1556:	Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D1557:	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort [56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)]
ASTM D2922:	Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D3017:	Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

C. State of California, Department of Transportation Standard Specifications current revision, hereafter called “Standard Specifications.”

D. San Joaquin County Department of Public Works Specifications, hereafter called “County Specifications.”

1.03 DEFINITIONS

Buried Utility: Any buried pipe, duct, conduit, or cable

1.04 SUBMITTALS

A. “Section 01 33 00: Submittal Procedures”: Requirements for submittals

B. Excavation Protection Plan (Trench Safety Plan): Refer to “Section 31 50 00: Excavation Support and Protection.” Describe sheeting, shoring, and bracing materials and installation required to protect personnel, excavations, and adjacent structures and property; include structural calculations to support plan.

Calculations and design of shoring and sheeting included in the trench safety plan shall be stamped and signed by an Engineer presently registered in the State of California.

1.05 QUALITY ASSURANCE

Perform Work in accordance with Standard Specifications, County Specifications, and these Specifications. In the case of conflict, the most stringent shall govern. Advise the Engineer of the conflict before proceeding.

1.06 COORDINATION

Verify Work associated with lower elevation utilities is complete before placing higher elevation utilities.

PART 2. PRODUCTS

2.01 FILL MATERIALS

Fill materials are indicated on the Drawings and specified in “Section 31 00 00: Earthwork”

PART 3. EXECUTION

3.01 LINES AND GRADES

A. Lay pipes to lines and grades indicated on Drawings.

Engineer reserves right to make changes in lines, grades, and depths of utilities when changes are required for Project conditions.

B. Use laser-beam instrument with qualified operator to establish lines and grades.

3.02 PREPARATION

A. Call Underground Service Alert at 1-800-227-2600 not less than 2 working days before performing Work. Request underground utilities to be located and marked within and surrounding construction areas. Notify Owner and Engineer of unanticipated conflicts before proceeding.

B. Identify required lines, levels, contours, and datum locations.

C. Protect plant life, lawns, rock outcropping, and other features remaining as portion of final landscaping.

D. Protect benchmarks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

E. Maintain and protect above and below grade utilities indicated to remain.

F. Establish temporary traffic control and detours when trenching is performed in public right-of-way. Relocate controls and reroute traffic as required during progress of Work.

3.03 NOTIFICATION OF SERVICE INTERRUPTION

A. If water service to any resident or business within the work area will be interrupted during portions of the Work, the Contractor shall notify the Engineer and all affected residents and businesses at least 2 full working days in advance of anticipated water shutdowns. Unless otherwise noted on the Drawings, the maximum duration for water shutdown is 4 hours. Periods of shutdown must be between the hours of 8:00 p.m. and 6:00 a.m.

3.04 TRENCHING

A. Excavate topsoil and subsoil required for utility installation. Stockpile topsoil separately for subsequent placement in the upper portion of the trench backfill in unpaved areas. For excavation of paved surfaces, grind or sawcut neat edge along asphalt no wider than width of trench, as shown on the Drawings.

B. Cut trenches to width indicated on Drawings. Remove water or materials that interfere with Work.

C. Excavate walls and bottom of trenches maximum 2 feet wider than outside diameter of pipe, or as shown in the details of the Drawings.

D. Excavate trenches to depth indicated on Drawings. Provide uniform and continuous bearing and support for bedding material and pipe and existing utilities.

E. When subsurface materials at bottom of trench are loose, soft, or water-saturated, advise Engineer before proceeding. In the presence of the Engineer, excavate until suitable material is encountered. Backfill with stabilization material conforming to these Specifications and consolidate until a firm, unyielding surface is developed, to the satisfaction of the Engineer.

F. Trim excavation. Hand trim for bell and spigot pipe joints. Remove loose matter.

G. Correct over-excavated areas with compacted native backfill or imported backfill.

H. Remove excess subsoil and asphalt concrete (AC) spoils or grindings from site and properly dispose of them in accordance with local ordinance. Provide the Engineer with a written copy of the agreement between the owner of the disposal site and the Contractor and a copy of any permit(s) required for placement of this material. This agreement shall hold the Engineer, the Owner, and the Owner's representatives harmless for any issues that arise from the disposal of the trench spoils.

3.05 SHEETING AND SHORING

A. Submit a shoring plan for excavations greater than 5 feet in accordance with "Section 01 33 00: Submittal Procedures" and "Section 31 50 00: Excavation Support and Protection."

3.06 BACKFILLING

A. Backfill trenches to surfaces or planes as indicated on the Drawings.

B. Maintain optimum moisture content of fill materials to attain required compaction density.

C. Do not leave trench open at end of working day. Backfill or place metal plates, suitable for allowable vehicular loads in traveled way, over all open excavations in the public right-of-way.

D. Bring the upper surface of the backfilled trench to the same level as the adjoining original surface with compacted aggregate base or temporary paving if the roadway is opened for public use before placement of the final AC pavement.

E. Provide traffic control devices, exclusionary fencing, and warning devices to prevent public entry to locations that present a danger to the public.

3.07 COMPACTING

A. Refer to “Section 31 00 00: Earthwork” for compaction requirements and frequency of tests.

3.08 TOLERANCES

A. “Section 01 40 00: Quality Requirements”: Tolerances

B. Do not exceed tolerances stated in Standard Specifications Section 26-1.03D.

3.09 FIELD QUALITY CONTROL

A. “Section 01 40 00: Quality Requirements”: Field inspecting and testing

B. Perform laboratory material tests in accordance with Standard Specifications, or ASTM as indicated by the Plans and Specifications.

C. Perform in-place compaction tests in accordance with ASTM D6938: Standard test method for in-place density and water content of soil and soil-aggregate by nuclear methods (shallow depth)

D. When tests indicate work does not meet specified requirements, correct the failing conditions and retest, or remove work, replace, compact, and retest. Contractor is responsible for paying for each retest required due to test failure.

E. Frequency of Tests: In accordance with Standard Specifications or as directed by Engineer.

3.10 PROTECTION OF FINISHED WORK

A. “Section 01 70 00: Execution and Closeout Requirements”: Protecting finished work

B. Reshape and re-compact fills subjected to vehicular traffic during construction.

END OF SECTION

APPENDIX A

ASBESTOS & LEAD
INSPECTION REPORT

FEBRUARY 25, 2020

BEM PROJECT NO. 20-42497

Site

Commercial
800 "J" Street
Lathrop, CA 95330

Prepared For

Mr. Eric Wohle
LDA Partners
222 Central Court
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Prepared By

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February 25, 2020

Mr. Eric Wohle
LDA Partners
222 Central Court
Stockton, CA 95204

Mr. Wohle:

Bovee Environmental Management, Inc. (BEM) is pleased to provide this Asbestos & Lead Paint Survey Report regarding our asbestos and lead inspection services at the Project Site summarized below.

PROJECT SUMMARY TABLE

PROJECT SITE TYPE	PROJECT SITE LOCATION	PROJECT SITE NOTE
Commercial	800 "J" Street, Lathrop, CA 95330	Renovation

INSPECTION TYPE	INSPECTED AREAS	INSPECTION DATE
Asbestos & Lead Inspection	Entire Building	February 24, 2020

ASBESTOS INSPECTION SUMMARY

Samples of building materials considered to be *suspect asbestos containing materials** were identified and collected from the inspected renovation areas referenced above to determine their asbestos content. Samples collected from specific areas for the purpose of renovation activities are determined by the client. There may be areas within the Subject Site that were not inspected and may contain additional suspect asbestos containing materials that were not sampled. Through proper chain-of-custody the collected samples are sent to BEM, Inc Laboratories for polarized light microscopy (PLM) analysis. A summary of all materials sampled and corresponding analytical results are listed below. Detailed information regarding sample number, actual sample location and analytical methods can be reviewed in attachments A and B.

SAMPLE COLLECTION SUMMARY

*See definitions on page 3.

#	MATERIAL SAMPLED	MATERIAL LOCATION	ASBESTOS	CATEGORY	SQ.FT.
42497-01	Linoleum	Various Floors Throughout	None Detected	-	-
42497-02	**Mastic**	**Various Floors Throughout**	**10% Chrysotile**	**Category I***	**2,000**
42497-03	**12" x 12" VFT**	**Lobby; Various Floors**	**2% Chrysotile**	**Category I***	**20**
42497-04	**Mastic**	**Lobby; Various Floors**	**10% Chrysotile**	**Category I***	↑
42497-05	**Vinyl Floor Tile**	**Bedroom 1; Floor Beneath Carpet**	**3% Chrysotile**	**Category I***	**350**
42497-06	**Mastic**	**Bedroom 1; Floor Beneath Carpet**	**20% Chrysotile**	**Category I***	↑
42497-07	**Cove Base Mastic**	**Baseboards Throughout**	**5% Tremolite**	**Category I***	**TBD****

Sample Collection Summary table continued on page 3.

#	MATERIAL SAMPLED	MATERIAL LOCATION	ASBESTOS	CATEGORY	SQ.FT.
42497-08	Ceramic Tile Cement	Bathrooms; Various Walls	None Detected	-	-
42497-09	Mortar	Various Interior/Exterior Walls	None Detected	-	-
42497-10	Wall Panel Mastic	Storage Closet; Various Walls	None Detected	-	-
42497-11	Surface Texture	Bedrooms/Billiard Room; Various Walls	None Detected	-	-
42497-12	**Sheetrock/Joint Compound**	**Bedrooms/Billiard Room; Various Walls**	**0.33% Chrysotile**	**-**	**2,000**
42497-13	**Surface Texture**	**Various Walls/Ceilings Throughout**	**3% Chrysotile**	**RACM***	**TBD****
42497-14	**Surface Texture**	**Various Walls/Ceilings Throughout**	**3% Chrysotile**	**RACM***	**TBD****
42497-15	**Surface Texture**	**Various Walls/Ceilings Throughout**	**3% Chrysotile**	**RACM***	**TBD****
42497-16	**Surface Texture**	**Various Walls/Ceilings Throughout**	**3% Chrysotile**	**RACM***	**TBD****
42497-17	**Surface Texture**	**Various Walls/Ceilings Throughout**	**3% Chrysotile**	**RACM***	**TBD****
42497-18	**Sheetrock/Joint Compound**	**Various Walls/Ceilings Throughout**	**<1% Chrysotile**	**-**	**TBD****
42497-19	**Sheetrock/Joint Compound**	**Various Walls/Ceilings Throughout**	**<1% Chrysotile**	**-**	**TBD****
42497-20	**Sheetrock/Joint Compound**	**Various Walls/Ceilings Throughout**	**<1% Chrysotile**	**-**	**TBD****
42497-21	**Acoustic Ceiling Spray**	**Various Ceilings Throughout**	**15% Chrysotile**	**RACM***	**1,000**
42497-22	Penetration Mastic	Upper/Lower Roofs; Perimeter Edges/Seams	None Detected	-	-
42497-23	Roofing Material	Lower East Roof (All Layers)	None Detected	-	-
42497-24	Roofing Material	Lower West Roof (All Layers)	None Detected	-	-
42497-25	Roofing Material	Upper Roof (All Layers)	None Detected	-	-

ASBESTOS DEFINITIONS

Suspect Asbestos Containing Material (ACM) - Local air quality management districts consider a material that is not wood, metal or glass, to be a suspect ACM. All suspect ACMs are assumed to contain asbestos until laboratory analysis confirms that a material has no asbestos content.

Category – ACM's are classified as either "friable", material that can be easily crushed or pulverized by normal hand pressure or as "non-friable", material that cannot be easily crushed or pulverized by normal hand pressure. *Friable ACMs are considered a Regulated Asbestos Containing Material (RACM) requiring Class I work practices and engineering controls. Non-friable ACMs are considered either Category I or Category II Asbestos Containing Material requiring Class II work practices and engineering controls.*

Trace - Analytical result that is equal to or less than 1.0 percent asbestos by weight, but greater than 0.1 percent. Materials with a trace amount of asbestos have to be removed as asbestos containing construction material (ACCM) according to Cal-OSHA, but can be disposed as non-ACM upon point count analyses according to federal and state EPA regulations.

Homogeneous – Multiple samples collected of a suspect material that is similar in general appearance and from areas that appear to have been constructed at the same time are considered homogeneous. If multiple samples are collected from a similar material within a homogeneous area and only one of the multiple samples is found to contain asbestos, regulations mandate that the entirety of that material with the homogeneous area must be considered an ACM.

VFT – Vinyl Floor Tile TBD – To be determined

ASBESTOS REGULATORY STANDARDS

California Occupational Safety and Health Administration (Cal-OSHA)

- Friable and Non-Friable ACCMs containing more than 0.1 percent asbestos by weight are regulated.
- Enforces regulations pertaining to workers performing ACCM removal and workers in close proximity.
- Contractors who disturb more than 100 square feet or 160 lineal feet of ACCM must be registered by the contractor's state license board as an asbestos removal contractor.
- Contractors who disturb any amount of ACCM must ensure employee protection by providing accredited training, medical examinations, personal protective equipment and a negative exposure assessment.

United States Environmental Protection Agency (EPA)

- Friable and Non-Friable ACMs containing more than 1.0 percent asbestos by weight are regulated.
- Enforces regulations pertaining to protecting the environment, not workers.
- Abatement Contractors who disturb more than 160 square feet or 260 linear feet of ACM must comply with the National Emissions Standards for Hazardous Air Pollutants Asbestos Regulations (40 CFR 61, Subpart M) and all state and federal requirements regarding asbestos.

Local Air Quality Control Districts

- Friable and Non-Friable ACM's containing more than 1.0 percent asbestos by weight are regulated.
- Enforces regulations pertaining to local air quality; "No Visible Air Emissions".
- Require an asbestos survey prior to renovation or demolition.
- Abatement Contractors who disturb more than 160 square feet or 260 linear feet of ACM must comply with the National Emissions Standards for Hazardous Air Pollutants Asbestos Regulations (40 CFR 61, Subpart M).

ASBESTOS RECOMMENDATIONS

BEM recommends compliance with all federal, state and local regulations concerning asbestos.

ASBESTOS WARRANTY

Samples of suspect asbestos containing building materials, which could be disturbed during construction activities, are collected by BEM. Site inspections and sample collection methodologies are performed to meet regulatory standards and industry protocols. BEM warrants that the findings contained herein have been promulgated in general accordance with accepted professional practices at the time of its preparation as applied by professionals in the community. There is a possibility that conditions may exist in which suspect ACM's could not be identified within the scope of the survey or were not apparent or accessible during the site visit. All scheduled work should cease and additional samples should be collected if unidentified suspect ACM's are discovered during construction activities.

If quantities of asbestos containing materials are stated in this report, they are supplied for budgetary and regulatory notification purposes only. They should not be relied on for abatement bidding purposes.

LEAD INSPECTION SUMMARY

BEM visually inspected and identified all components and substrates throughout the Subject Site that will be impacted during renovation activities. These surfaces were representatively sampled and analyzed for lead content. Utilizing an X-Ray Fluorescence Spectrometer (XRF), the substrates within the Subject Site's renovation/demolition areas were analyzed for their lead concentration levels. A summary of the substrates sampled and corresponding analytical results are listed below. Detailed information regarding sample numbers, actual sample locations and analytical methods can be reviewed in attachments A & B.

#	SAMPLE DESCRIPTION	SAMPLE LOCATION	LEAD mg/cm^2
42497-L1	Paint (Red)	Various Concrete Floors	0
42497-L2	Paint (White)	Various Sheetrock Walls/Ceilings	0
42497-L3	Paint (Blue)	Wood Trim Walls Throughout	0
42497-L4	**Ceramic Tile (White)**	**Bathrooms Lower Walls Throughout**	**>5.0**
42497-L5	Paint (Black)	Various Exterior Wood Trim Walls	0
42497-L6	Paint (Black)	Various Exterior Metal Trim Walls	0

(Lead Based = ≥ 1.0 mg/cm$^{2)}$ (Lead Containing = < 1.0 mg/cm$^{2)}$ (No Lead Detected = 0 mg/cm$^{2)}$

LEAD RECOMMENDATIONS

Any substrates listed in the table above having a lead concentration level greater than or equal to 1.0 mg/cm^2 should be considered lead based. If these substrates are to be impacted during renovation activities then proper lead abatement practices, engineering controls and worker protection should meet all regulatory standards mandated by Cal-OSHA Title 8.

Any substrates listed in the table above having a lead concentration level less than 1.0 mg/cm^2 should be considered lead containing. Regulations mandated by Cal-OSHA Title 8 are still in effect for renovation activities.

Any substrates listed in the table above having a lead concentration level of 0 mg/cm^2 should be considered lead free, however regulations mandate that all workers involved in renovation activities shall receive appropriate EPA-RRP lead awareness training so that activities which could potentially create an exposure risk can be avoided.

BEM recommends compliance with <u>all</u> federal, state and local regulations concerning lead paint.

LEAD WARRANTY

Site inspections and sample collection methodologies are performed to meet regulatory standards and industry protocols. BEM warrants that the findings contained herein have been promulgated in general accordance with accepted professional practices at the time of its preparation as applied by professionals in the community. There is a possibility that conditions may exist which could not be identified within the scope of the survey or were not apparent or accessible during the site visit.

DISCLAIMER

If asbestos containing materials were impacted and/or damaged during a fire loss, then the soft and/or porous building materials and personal contents should be removed and disposed of as Asbestos Containing Building Materials (ACBM). The hard and/or nonporous building materials and personal contents can be cleaned and decontaminated on site. The locations surrounding the damaged areas should be considered contaminated with asbestos. BEM cannot assume these other areas were not impacted with asbestos. BEM recommends to either assume the building materials and/or personal contents within these surrounding locations are contaminated with asbestos; or micro-vac TEM samples can be collected within these surrounding locations to determine if the asbestos contamination migrated to these surrounding locations adjacent to the known contamination.

CERTIFICATION

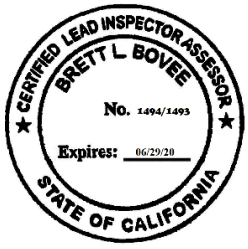
Inspection services relative to the Subject Site were provided by BEM's Mr. Brett L. Bovée & Anthony J. Miller, Certified Asbestos Consultants, No. 95-1643, expiration on 03/08/2020 & Number 19-6474, expiration on 04/17/2020. and a California Department of Public Health Inspector/Assessor, ID# 1494/1493, expiration on 06/29/2020.

BEM looks forward to assisting you in the near future. If you have any questions regarding this report or other BEM services, please do not hesitate to call us at (209) 847-3800 or (559) 264-3800.

Regards,

Brett L. Bovée

Brett L. Bovée, CAC, CMC, CDPH
Certified Asbestos Consultant No. 95-1643
California DPH Inspector/Assessor, ID# 1494/1493



Anthony J. Miller

Anthony J. Miller
Certified Asbestos Consultant
No: 19-6474

ATTACHMENT A

BEM

SAMPLE FIELD SHEETS

Bovee Environmental Management, Inc.
1900 McHenry Ave, Ste 201, Escalon, CA 95320
North Valley: 209-847-3800 • South Valley: 559-264-3800
Email: bem@boveeinc.com • Facsimile: 209-847-3830

CHAIN OF CUSTODY

BEM PROJECT #	20-42497	TURN-AROUND TIME
SAMPLE DATE:	02/24/20	○ SAME DAY ● 24HOURS
SURVEY TYPE:	Reno	○

Project Name:	Commercial
Address:	800 "J" street, Lathrop, CA 95330
Type of Loss:	Reno
Areas Inspected:	Entire Building

Point Count Trace Results: ●YES-400 ○ YES-1000 ○ NO

Sample#	Sample Description	Surface	T. Time	LPM	Vol./Qua.	PLM	XRF	PCM	DIRECT-101	E-COLI	TEM	AAS	
42497 01	Mat. Desc.: Lino Mat. Loc.: various throughout	W C FL ○○●				●	○	○	○	○	○	○	○
02	Mat. Desc.: Mastic ↓ Mat. Loc.:	W C FL ○○●				●	○	○	○	○	○	○	○
03	Mat. Desc.: 12x12 VFT Mat. Loc.: Lobby various	W C FL ○○●				●	○	○	○	○	○	○	○
04	Mat. Desc.: Mastic ↓ Mat. Loc.:	W C FL ○○●				●	○	○	○	○	○	○	○
05	Mat. Desc.: VFT Mat. Loc.: Bedroom 1 beneath carpet	W C FL ○○●				●	○	○	○	○	○	○	○
06	Mat. Desc.: Mastic ↓ Mat. Loc.:	W C FL ○○●				●	○	○	○	○	○	○	○
07	Mat. Desc.: CBM Mat. Loc.: throughout	W C FL ●○○				●	○	○	○	○	○	○	○
08	Mat. Desc.: CT cement Mat. Loc.: Bathrooms various	W C FL ●○○				●	○	○	○	○	○	○	○
09	Mat. Desc.: Mortar Mat. Loc.: various interior and exterior	W C FL ●○○				●	○	○	○	○	○	○	○
10	Mat. Desc.: Wall panel mastic Mat. Loc.: storage closet various	W C FL ●○○				●	○	○	○	○	○	○	○
11	Mat. Desc.: ST Mat. Loc.: Bedrooms, Billiard room various	W C FL ●○○				●	○	○	○	○	○	○	○
12	Mat. Desc.: SR/JC ↓ Mat. Loc.:	W C FL ●●○				●	○	○	○	○	○	○	○
13	Mat. Desc.: ST Mat. Loc.: various throughout	W C FL ●●○				●	○	○	○	○	○	○	○
14	Mat. Desc.: ↓ Mat. Loc.:	W C FL ●●○				●	○	○	○	○	○	○	○
15	Mat. Desc.: Mat. Loc.:	W C FL ●●○				●	○	○	○	○	○	○	○
16	Mat. Desc.: Mat. Loc.:	W C FL ●●○				●	○	○	○	○	○	○	○
17	Mat. Desc.: Mat. Loc.:	W C FL ●●○				●	○	○	○	○	○	○	○
18	Mat. Desc.: SR/JC Mat. Loc.: various throughout	W C FL ●●○				●	○	○	○	○	○	○	○

Relinquished by:	Received by:	Relinquished by:	Received by:
B BOVEE	Raquel Dominguez	Raquel Dominguez	Anthony Miller
*	X	X	X
Time/Date: 02/24/20	Time/Date: 2/24/20	Time/Date: 2/24/20	Time/Date: 2/24/20

Bovee Environmental Management, Inc.
1900 McHenry Ave, Ste 201, Escalon, CA 95320
North Valley: 209-847-3800 • South Valley: 559-264-3800
Email: bem@boveeinc.com • Facsimile: 209-847-3830

CHAIN OF CUSTODY

BEM PROJECT #		TURN-AROUND TIME
SAMPLE DATE:		○ SAME DAY ○ 24HOURS
SURVEY TYPE:		○

Project Name:	
Address:	
Type of Loss:	
Areas Inspected:	

Point Count Trace Results
○ YES-400 ○ YES-1000 ○ NO

Sample#	Sample Description	Surface (W C FL)	T. Time	LPM	Vol./Qua.	PLM	XRF	PCM	DIRECT-101	E-COLI	TEM	AAS
42497 19	Mat. Desc.: SR/JC Mat. Loc.: various	●●○				●	○	○	○	○	○	○
20	Mat. Desc.: ↓ Mat. Loc.:	●●○				◐	○	○	○	○	○	○
21	Mat. Desc.: ACS Mat. Loc.: various	○●○				◐	○	○	○	○	○	○
22	Mat. Desc.: Pen mastic Mat. Loc.: upper/Lower roofs perimeter edges/seams	○○○				◐	○	○	○	○	○	○
23	Mat. Desc.: R.M Mat. Loc.: Lower East roof All-layers	○○○				◐	○	○	○	○	○	○
24	Mat. Desc.: R.M Mat. Loc.: Lower west roof All-layers	○○○				◐	○	○	○	○	○	○
25	Mat. Desc.: R.M Mat. Loc.: upper roof All-layers	○○○				●	○	○	○	○	○	○
	Mat. Desc.: Mat. Loc.:	○○○				○	○	○	○	○	○	○
42497 L1	Mat. Desc.: Paint red(concrete) Mat. Loc.: various	○○●	Neg	↓		○	◐	○	○	○	○	○
L2	Mat. Desc.: Paint white(SR) Mat. Loc.: various	●●○				○	●	○	○	○	○	○
L3	Mat. Desc.: Paint Blue(wood) Mat. Loc.: trim throughout	●○○				○	◐	○	○	○	○	○
L4	Mat. Desc.: LT white Mat. Loc.: Bathrooms lower wall throughout	◐○○	Pos	75.00		○	●	○	○	○	○	○
L5	Mat. Desc.: Paint Black(wood) Mat. Loc.: various exterior trim	◐○○	Neg			○	◐	○	○	○	○	○
L6	Mat. Desc.: Paint Black(Metal) Mat. Loc.: various exterior trim	●○○		↓		○	◐	○	○	○	○	○
	Mat. Desc.: Mat. Loc.:	○○○				○	○	○	○	○	○	○
	Mat. Desc.: Mat. Loc.:	○○○				○	○	○	○	○	○	○
	Mat. Desc.: Mat. Loc.:	○○○				○	○	○	○	○	○	○
	Mat. Desc.: Mat. Loc.:	○○○				○	○	○	○	○	○	○

Relinquished by:	Received by:	Relinquished by:	Received by:
B. BOVEE	Raquel Dominguez	Raquel Dominguez	Anthony Miller
*	X	X	X
Time/Date: 02/24/20	Time/Date: 2/24/20	Time/Date: 2/24/20	Time/Date: 2/24/20

ATTACHMENT B

LABORATORY ANALYTICAL REPORTS

February 25, 2020

Bovee Environmental Management, Inc.
1900 McHenry Avenue, #201
Escalon, CA 95320

Client Project: 20-42497
Report ID: 20-AE829

Dear Customer:

Enclosed are asbestos analysis results for PLM Bulk samples received at our laboratory on **February 24, 2020**. The samples were analyzed for asbestos using polarizing light microscopy (PLM) under EPA 600 Method.

Sample results containing >1% asbestos are considered asbestos-containing materials (ACMs) per EPA regulatory requirements. The detection limit for the EPA 600 Method is <1% asbestos by weight as determined by visual estimation.

Kind Regards,

Anthony Miller

Anthony Miller
Laboratory Director

ASBESTOS ANALYTICAL REPORT

By: Polarized Light Microscopy

Prepared for

Bovee Environmental Management, Inc.

CLIENT PROJECT: 20-42497

REPORT ID: 20-AE829

TEST METHOD: EPA 600/R93/116 and EPA 600/M4-82/020

REPORT DATE: 02-25-20

TOTAL SAMPLES ANALYZED: 25

 # SAMPLES >1% ASBESTOS: 12

1900 McHenry Avenue, Suite 201 • Escalon, CA • Office 209-847-3800• Fax 209-847-3830

ASBESTOS REPORT SUMMARY

By: POLARIZED LIGHT MICROSCOPY

Client Project: 20-42497 **Report ID:** 20-AE829

Methodology: EPA 600/R-93/116 and EPA 600/M4-82/020

Client ID	Layer	Lab ID	Color	Sample Description	% Asbestos
42497-01		AE-7148	White Speckle	Linoleum	None Detected
42497-02		AE-7149	Yellow, Black	Mastic	**10% Chrysotile**
42497-03		AE-7150	Tan, Brown	12x12 VFT	**2% Chrysotile**
42497-04		AE-7151	Black	Mastic	**10% Chrysotile**
42497-05		AE-7152	Red	VFT	**3% Chrysotile**
42497-06		AE-7153	Black	Mastic	**20% Chrysotile**
42497-07		AE-7154	Yellow, Brown	Cove Base Mastic	**5% Tremolite**
42497-08		AE-7155	White	Ceramic Tile Cement	None Detected
42497-09		AE-7156	Tan	Mortar	None Detected
42497-10		AE-7157	Tan	Wall Panel Mastic	None Detected
42497-11		AE-7158	White, Brown	Surface Texture	None Detected
42497-12		AE-7159	White	Sheetrock/Joint Compound	**<1% Chrysotile**
42497-13		AE-7160	White	Surface Texture	**3% Chrysotile**
42497-14		AE-7161	White	Surface Texture	**3% Chrysotile**
42497-15		AE-7162	White	Surface Texture	**3% Chrysotile**
42497-16		AE-7163	White	Surface Texture	**3% Chrysotile**
42497-17		AE-7164	White	Surface Texture	**3% Chrysotile**
42497-18		AE-7165	White	Sheetrock/Joint Compound	**<1% Chrysotile**
42497-19		AE-7166	White	Sheetrock/Joint Compound	**<1% Chrysotile**
42497-20		AE-7167	White	Sheetrock/Joint Compound	**<1% Chrysotile**
42497-21		AE-7168	White	Acoustic Ceiling Spray	**15% Chrysotile**
42497-22		AE-7169	White	Penetration Mastic	None Detected
42497-23		AE-7170	Gray, Black	Roofing Material	None Detected
42497-24		AE-7171	Gray, Black	Roofing Material	None Detected
42497-25		AE-7172	Gray, Black	Roofing Material	None Detected

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ASBESTOS BULK ANALYSIS

By: POLARIZED LIGHT MICROSCOPY

Report ID: 20-AE829
Date Received: 02-24-20
Date Analyzed: 02-25-20
Date Reported: 02-25-20

Client Project: 20-42497

Methodology: EPA 600/R-93/116 and EPA 600/M4-82/020

Client ID Sample ID	Lab Description	Lab Attributes	NON-ASBESTOS COMPONENTS Fibrous		 Non-Fibrous		ASBESTOS %
42497-01 AE-7148	Linoleum	Heterogeneous White Speckle Fibrous Bound	10% 30%	Fiberglass Cellulose	35% 25%	Vinyl Binder	None Detected
42497-02 AE-7149	Mastic	Heterogeneous Yellow, Black Fibrous Bound	20%	Cellulose	70%	Mastic	**10% Chrysotile**
42497-03 AE-7150	12x12 VFT	Heterogeneous Tan, Brown Non-Fibrous Bound			40% 38% 20%	Vinyl Binder Silicates	**2% Chrysotile**
42497-04 AE-7151	Mastic	Homogeneous Black Non-Fibrous Bound			90%	Mastic	**10% Chrysotile**
42497-05 AE-7152	VFT	Heterogeneous Red Non-Fibrous Bound			30% 47% 20%	Vinyl Binder Silicates	**3% Chrysotile**
42497-06 AE-7153	Mastic	Heterogeneous Black Fibrous Bound			5% 75%	Silicates Mastic	**20% Chrysotile**
42497-07 AE-7154	Cove Base Mastic	Heterogeneous Yellow, Brown Non-Fibrous Bound			95%	Mastic	**5% Tremolite**
42497-08 AE-7155	Ceramic Tile Cement	Homogeneous White Non-Fibrous Tightly Bound			10% 90%	Silicates Binder	None Detected
42497-09 AE-7156	Mortar	Heterogeneous Tan Non-Fibrous Tightly Bound			30% 50% 20%	Silicates Binder Gravel	None Detected

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ASBESTOS BULK ANALYSIS

By: POLARIZED LIGHT MICROSCOPY

Report ID: 20-AE829
Date Received: 02-24-20
Date Analyzed: 02-25-20
Date Reported: 02-25-20

Client Project: 20-42497

Methodology: EPA 600/R-93/116 and EPA 600/M4-82/020

Client ID Sample ID	Lab Description	Lab Attributes	NON-ASBESTOS COMPONENTS Fibrous		Non-Fibrous		ASBESTOS %
42497-10 AE-7157	Wall Panel Mastic	Homogeneous Tan Non-Fibrous Bound			100%	Mastic	None Detected
42497-11 AE-7158	Surface Texture	Heterogeneous White, Brown Fibrous Bound	20%	Synthetic	5% 10% 10% 55%	Paint Mastic Gypsum Binder	None Detected
42497-12 AE-7159	Sheetrock/ Joint Compound	Heterogeneous White Fibrous Bound	20%	Cellulose	25% 15% 40%	Gypsum Calc Carb Binder	**<1% Chrysotile**
Lab Notes: Joint Compound Contains 2% Chrysotile: <1% Composite							
42497-13 AE-7160	Surface Texture	Heterogeneous White Fibrous Bound			67% 30%	Binder Calc Carb	**3% Chrysotile**
42497-14 AE-7161	Surface Texture	Heterogeneous White Fibrous Bound			67% 30%	Binder Calc Carb	**3% Chrysotile**
42497-15 AE-7162	Surface Texture	Heterogeneous White Fibrous Bound			67% 30%	Binder Calc Carb	**3% Chrysotile**
42497-16 AE-7163	Surface Texture	Heterogeneous White Fibrous Bound			67% 30%	Binder Calc Carb	**3% Chrysotile**
42497-17 AE-7164	Surface Texture	Heterogeneous White Fibrous Bound			67% 30%	Binder Calc Carb	**3% Chrysotile**

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ASBESTOS BULK ANALYSIS

By: POLARIZED LIGHT MICROSCOPY

Report ID: 20-AE829
Date Received: 02-24-20
Date Analyzed: 02-25-20
Date Reported: 02-25-20

Client Project: 20-42497

Methodology: EPA 600/R-93/116 and EPA 600/M4-82/020

Client ID Sample ID	Lab Description	Lab Attributes	NON-ASBESTOS COMPONENTS Fibrous		Non-Fibrous		ASBESTOS %
42497-18 AE-7165	Sheetrock/ Joint Compound	Heterogeneous White Fibrous Bound	20%	Cellulose	25% 20% 35%	Gypsum Calc Carb Binder	**<1% Chrysotile**
Lab Notes: Joint Compound Contains 2% Chrysotile: <1% Composite							
42497-19 AE-7166	Sheetrock/ Joint Compound	Heterogeneous White Fibrous Bound	20%	Cellulose	25% 20% 35%	Gypsum Calc Carb Binder	**<1% Chrysotile**
Lab Notes: Joint Compound Contains 2% Chrysotile: <1% Composite							
42497-20 AE-7167	Sheetrock/ Joint Compound	Heterogeneous White Fibrous Bound	20%	Cellulose	25% 20% 35%	Gypsum Calc Carb Binder	**<1% Chrysotile**
Lab Notes: Joint Compound Contains 2% Chrysotile: <1% Composite							
42497-21 AE-7168	Acoustic Ceiling Spray	Heterogeneous White Fibrous Loosely Bound	5%	Fiberglass	20% 50% 5% 5%	Calc Carb Binder Paint Foam	**15% Chrysotile**
42497-22 AE-7169	Penetration Mastic	Heterogeneous White Non-Fibrous Bound			40% 60%	Binder Silicone	None Detected
42497-23 AE-7170	Roofing Material	Heterogeneous Gray Black Fibrous Bound	35% 15%	Cellulose Fiberglass	20% 30%	Gravel Tar	None Detected
42497-24 AE-7171	Roofing Material	Heterogeneous Gray Black Fibrous Bound	20% 15%	Cellulose Fiberglass	20% 35% 10%	Gravel Tar Silicates	None Detected
42497-25 AE-7172	Roofing Material	Heterogeneous Gray Black Fibrous Bound	10% 20%	Cellulose Fiberglass	25% 35% 10%	Gravel Tar Silicates	None Detected

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LEGEND:	Non-Anth	= Non-Asbestiform Anthophyllite
	Non-Trem	= Non-Asbestiform Tremolite
	Calc Carb	= Calcium Carbonate

METHOD: EPA 600/R-93/116 and EPA 600/M4-82/020

REPORTING LIMIT: <1% by Visual Estimation

REPORTING LIMIT FOR POINT COUNTS: 0.25% by 400 Points or 0.1% by 1,000 Points

REGULATORY LIMIT: >1% by Weight

Samples were received in acceptable condition unless otherwise noted. All samples are received from the client; therefore, BEM Laboratories is not responsible for any of the sampling procedures.

Due to the limitations of the EPA 600 method, nonfriable organically bound materials (NOB's) such as vinyl floor tiles can be difficult to analyze via polarized light microscope (PLM). EPA recommends that all NOB's analyzed by PLM, and found not to contain asbestos, be further analyzed by Transmission Electron Microscopy (TEM).
BEM is accredited with the Environmental Laboratory Accreditation Program (ELAP) under Certificate Number 3013.
BEM successfully participates in the American Industrial Hygiene Association's (AIHA) Bulk Asbestos Proficiency Analytical Testing Program (BAPAT) under Laboratory Identification Number 221538 and the National Voluntary Laboratory Accreditation Program's (NVLAP) Bulk Asbestos Proficiency Test under Lab Code 901038.

This report applies to the standards and/or procedures identified and to the sample (s) tested. The test results are not indicative or representative of the lot from which the sample was taken or apparently identical or similar products. These reports are for the exclusive use of the addressed client and are released on the condition that they will not be reproduced without special written permission; therefore, BEM laboratories can provide assurance that no parts of the report are taken out of context. Samples not destroyed during testing are retained for a maximum of thirty days. All analyses are derived from calibrated visual estimate unless otherwise noted.

Laboratory Director: Anthony Miller
Anthony Miller

Analyst: Anthony Miller
Anthony Miller

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February 25, 2020

Bovee Environmental Management, Inc.
1900 McHenry Avenue, #201
Escalon, CA 95320

Client Project: 20-42497
Report ID: 20-AE829A

Dear Customer:

Enclosed are asbestos analysis results for PLM Bulk samples received at our laboratory on **February 24, 2020**. The samples were analyzed for asbestos using polarizing light microscopy (PLM) under EPA 600 Method.

Sample results containing >1% asbestos are considered asbestos-containing materials (ACMs) per EPA regulatory requirements. The detection limit for the EPA 600 Method is 0.25% for 400 point counts, or 0.1% for 1,000 point counts.

Kind Regards,

Anthony Miller

Anthony Miller
Laboratory Director

ASBESTOS ANALYTICAL REPORT

By: Polarized Light Microscopy

CLIENT PROJECT: 20-42497

REPORT ID: 20-AE829A

TEST METHOD: PLM Point Count

EPA 600/R93/116 and EPA 600/M4-82/020

REPORT DATE: 02-25-20

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ASBESTOS BULK ANALYSIS

By: POLARIZED LIGHT MICROSCOPY

Report ID: 20-AE829A
Date Received: 02-24-20
Date Analyzed: 02-25-20
Date Reported: 02-25-20

Client Project: 20-42497

ASBESTOS POINT COUNT PLM, EPA 600 METHOD

Client ID	Sample ID	Material Description	Points Total	Points Asbestos	ASBESTOS %
42497-12	AE-7159A	Joint Compound	400	11	**2.75% Chrysotile**

2.75% Chrysotile = (11 Asbestos Points / 400 Total Points) x 100

	AE-7159A	Sheetrock/Joint Compound (Composite Result from Point Count)	400		**0.33% Chrysotile**

Lab Notes: Joint Compound is 12% of Overall Sample (**12%** x **2.75%** Chrysotile) / 100 = **0.15%** Chrysotile

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LEGEND: None

METHOD: EPA 600/M4-82/020 (40 CFR Part 763, Subpart E, Appendix E)

REPORTING LIMIT: 0.25% by 400 Points or 0.1% by 1,000 Points

REGULATORY LIMIT: >1% by Weight

Samples were received in acceptable condition unless otherwise noted. All samples are received from the client; therefore, BEM Laboratories is not responsible for any of the sampling procedures.

Due to the limitations of the EPA 600 method, nonfriable organically bound materials (NOB's) such as vinyl floor tiles can be difficult to analyze via polarized light microscope (PLM). EPA recommends that all NOB's analyzed by PLM, and found not to contain asbestos, be further analyzed by Transmission Electron Microscopy (TEM).
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This report applies to the standards and/or procedures identified and to the sample (s) tested. The test results are not indicative or representative of the lot from which the sample was taken or apparently identical or similar products. These reports are for the exclusive use of the addressed client and are released on the condition that they will not be reproduced without special written permission; therefore, BEM laboratories can provide assurance that no parts of the report are taken out of context. Samples not destroyed during testing are retained for a maximum of thirty days. All analyses are derived from calibrated visual estimate unless otherwise noted.

Laboratory Director: Anthony Miller
Anthony Miller

Analyst: Anthony Miller
Anthony Miller

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ATTACHMENT C

SITE DRAWING

20-42497

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E + W
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