100% DSA SUBMITTAL

EHS Home Economics Classroom

1535 N. Broadway, Escondido, CA 92026

3221022

Escondido Union High School District

302 North Midway Dr., Escondido, CA 92027

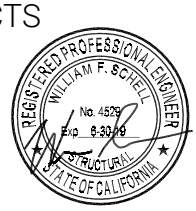
October 2, 2018

EHS HOME ECONOMICS CLASSROOM
ESCONDIDO UNION HIGH SCHOOL DISTRICT
ESCONDIDO, CA

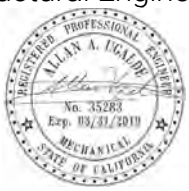
October 2, 2018

HMC # 3221022

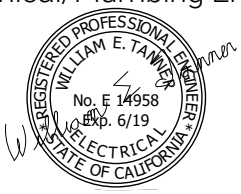
HMC ARCHITECTS
Architect



GSSI
Structural Engineers



IMEG CORP.
Mechanical/Plumbing Engineers



TANNER ENGINEERING
Electrical Engineers

FILE NUMBER: 37-H2

IDENTIFICATION STAMP
DIVISION OF THE STATE ARCHITECT

APP. NO: 04 - 117093 INCR : 0

AC DH FLS EA SS GL

DATE 10/02/2018

TABLE OF CONTENTS

DIVISION 09 - FINISHES

DIVISION 10 - SPECIALTIES

DIVISION 11 - EQUIPMENT

DIVISION 22 - PLUMBING

DIVISION 23 - HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

END OF TABLE OF CONTENTS

SECTION 01 10 00

SUMMARY OF WORK

PART 1 - GENERAL

1.01 SUMMARY OF WORK

A. This Contract includes work necessary for and incidental to execution and completion of

EHS HOME ECONOMICS CLASSROOM
ESCONDIDO UNION HIGH SCHOOL DISTRICT
ESCONDIDO, CA

in accordance with Contract Documents dated March 29, 2018 prepared by HMC Architects, 341 S. Cedros Ave., Studio B, Solana Beach, CA 92075.

1.02 GENERAL DESCRIPTION OF WORK

A. Work under this Contract includes furnishing all labor, materials, services and transportation, except as specifically excluded which is required for completion of Project in accordance with provisions of Contract Documents.

B. Work to be included as part of this Contract:
1. Remodel of existing classroom building to accommodate a home economics cirriculum.

C. The following restrictions apply to access and to use of site and existing buildings:
1. General: During construction period, Contractor shall have full use of premises for construction operations, including use of site. Contractor's use of premises is limited only by Owner's right to perform work or to retain other contractors on portions of Project.
2. Use of Site: Limit use of premises to Work in areas indicated. Confine operations to areas within Contract limits indicated. Do not disturb portions of site beyond areas in which Work is indicated. Allow for Owner occupancy and use by public.
3. Use of Existing Building: Maintain existing building in weather-tight conditions throughout construction period. Repair damage caused by construction operations. Take all precautions necessary to protect building and its occupants during construction period.
4. Driveways and Entrances: Keep driveways and entrances serving premises clear and accessible to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on site.

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

E. Limit site disturbance, including earthwork and clearing of vegetation, to 5 feet beyond primary roadway curbs, walkways, and main utility branch trenches; and 25 feet beyond pervious paving areas.

1.03 PERMISSIBLE WORKING DAYS AND HOURS

A. Work may be conducted on regularly scheduled school attendance days between the hours of 7:00 A.M. and 4:00 P.M.

B. Work may be conducted at any hour during Saturdays, and non-school session days, at no extra cost to the Owner, when written notification to Owner has been submitted and anticipated schedule of Work activities has been approved.

C. Conform to Division 01, General Requirements for required payment for Inspector's services performed during overtime hours.

1.04 INTERRUPTION OF EXISTING UTILITY SERVICES

A. When necessary to interrupt any existing utility service to make connections, minimum of 48 hours advance notice shall be given to Owner and Architect. Interruptions in utility services shall be of shortest possible duration for Work at hand and shall be approved by Architect.

B. In event any utility service is interrupted without required 48 hours notice, Contractor shall be financially liable for all damages suffered by Owner due to unauthorized interruption.

1.05 VERIFICATION OF EXISTING CONDITIONS

A. Contractor shall be responsible to examine site of Work and after investigation to decide for himself/herself character of materials, equipment and utilities to be encountered and all other existing conditions affecting Work. Contractor is also responsible to provide sufficient costs to cover provisions of all items of Work under existing conditions referred to herein.

PART 2 - PRODUCTS

2.01 NOT USED.

PART 3 - EXECUTION

3.01 NOT USED.

END OF SECTION

SECTION 01 20 00

PRICE AND PAYMENT PROCEDURES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Changes in the Work.

B. Schedule of Values.

1.02 CHANGES IN THE WORK

A. Approval by Division of the State Architect (DSA) Required: Changes in the Work affecting Structural Safety, Access or Fire and Life Safety, will be submitted for DSA approval, using Form DSA-140 (Application for Approval of Construction Change Document - Category A) in accordance with CAC Section 4-338(c), prior to commencing the work described therein. Changes not affecting Structural Safety, Access or Fire and Life Safety (Form DSA-141 Application for Concurrence of Construction Change Document - Category B) will not be submitted for approval, only if required by DSA in writing.

B. Minor Changes in the Work: Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710 or Architect's form, accompanied by Form DSA-141 or approved Form DSA-140.

C. Proposal Requests
   1. Owner-Initiated Proposal Requests - Work Change Proposal Request (WCPR): Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time, on AIA Document G709 or Architect's form, referencing Form DSA-140 or DSA-141. If necessary, the description will include supplemental or revised Drawings and Specifications.
      a. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
      b. Within time specified in the General and Supplementary Conditions after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
         1) 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.
         2) Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
         3) Include costs of labor and supervision directly attributable to the change.

4) Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
5) Quotation Form: Use CSI Form 13.6A, "Change Order Request (Proposal)," with attachments CSI Form 13.6D, "Proposal Worksheet Summary," and Form 13.6C, "Proposal Worksheet Detail."
a) The CSI Forms mentioned above are available for purchase at www.cisresources.org.

2. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect .
a. 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.
b. 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.
c. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
d. Include costs of labor and supervision directly attributable to the change.
e. 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.
f. Comply with requirements in Section 01 60 00 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
g. Proposal Request Form: Use CSI Form 13.6A, "Change Order Request (Proposal)," with attachments CSI Form 13.6D, "Proposal Worksheet Summary," and Form 13.6C, "Proposal Worksheet Detail."
1) The CSI Forms mentioned above are available for purchase at www.cisresources.org.

D. Construction Change Directive to the Contractor
1. Construction Change Directive: Architect will issue a Construction Change Directive on AIA Document G714 or Architect’s form, accompanied by DSA-approved Form DSA-140 or Form DSA-141 or both, and completed WCPR (Work Change Proposal Request). Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order. Copy will be issued to the Project Inspector.
a. 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.
2. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

a. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract, using CSI Form 13.6A, "Change Order Request (Proposal)," with attachments CSI Form 13.6D, "Proposal Worksheet Summary," and Form 13.6C, "Proposal Worksheet Detail.".
   1) The CSI Forms mentioned above are available for purchase at www.cisresources.org.

E. Change Orders Procedures: On Owner's approval of a completed Construction Change Directive, Architect will prepare and issue a Change Order for signatures of the Owner and Contractor on AIA Document G701 or Architect's form. Copies of signed Change Order will be distributed to Architect, IOR and Contractor, and submitted for Board Approval.
   1. Stipulated Price Change Order: Based on Contractor's Change Order Request as approved by Architect.
   2. Time and Material Change Orders: Submit itemized account and supporting data after completion of change within time limits indicated in Conditions of Contract. Architect will determine change allowable in Contract Price and Contract Time as provided in Contract Documents.
   3. Maintain detailed records of work done on Time and Material basis. Provide full information required for evaluation of proposed changes, and to substantiate costs for changes in Work.
   4. Refer to the General and Supplementary Conditions for additional requirements.
   5. Execution of Change Orders: Architect will issue Change Orders for signature of parties as provided in Conditions of the Contract.

1.03 SCHEDULE OF VALUES

A. Submit printed schedule on AIA Forms G702 and G703 - Application and Certificate for Payment and Continuation Sheet. Contractor's standard form or electronic media printout will be considered, submit sample forms to Architect for approval.

B. Submit application for progress payment in accordance with the General and Supplementary Conditions.

C. Submit Schedule of Values in duplicate within 15 calendar days after date of Owner-Contractor Agreement for Architect's approval.

D. Format: Utilize Table of Contents of this Project Manual. Identify each line item with number and title of the major Specification Section. Identify site mobilization and bonds and insurance. On projects of more than one building, list buildings separately. List mechanical, electrical, plumbing and fire protection Work separately for each building and for site Work.

E. Break down the plumbing and mechanical portions of the work at a minimum into a rough, finish, including air balance and electrical portion.

F. Break out rough grading, fine grading, and underground utilities.

G. Include separate line items, showing amount of General Contractor's overhead and profit, bonds and insurance, supervision, and then remainder of general items.

H. Revise schedule to list approved Change Orders, with each Application for Payment.

PART 2 - PRODUCTS

2.01 NOT USED.

PART 3 - EXECUTION

3.01 NOT USED.

END OF SECTION

SECTION 01 26 10

REQUESTS FOR INFORMATION (RFI)

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Administrative requirements for Requests for Information (RFI).

1.02 DEFINITIONS

A. Request for Information:
   1. Written request prepared by Contractor requesting additional information necessary to clarify an item which he believes is not clearly shown or called for in the drawings or specifications, or to address problems which have arisen under field conditions, hereinafter referred to as RFI.
   2. Properly prepared request for information shall include detailed written statement that indicates specific Drawings or Specification in need of clarification and nature of clarification requested.
      a. Drawings shall be identified by Drawing number and location on Drawing sheet.
      b. Specifications shall be identified by Section number, page and paragraph.
      c. Include name and project number for Architect and Authority Having Jurisdiction (AHJ).
   3. Contractor’s documents with similar titles, such as "Request for Interpretation" or "Request for Clarification" shall be considered RFIs.
   4. RFIs and Architect’s responses are not Changes in the Work; if a Change in the Work is required in response to an RFI, separate documents shall be issued in accordance with Section 01 20 00.

B. Improper RFIs:
   1. RFIs that are not properly prepared or incomplete.
   2. Improper RFIs will be processed by Architect at Architect's standard hourly rate and Architect will charge Owner, and such costs will be deducted from moneys still due the Contractor. Architect will notify Contractor before processing of improper RFIs.

C. Frivolous RFIs:
   1. RFIs that request information that is clearly shown on Contract Documents.
   2. Frivolous RFIs may be returned unanswered or may be processed by Architect at Architect's standard hourly rate and Architect will charge Owner, and such costs will be deducted from moneys still due Contractor. Architect will notify Contractor before processing of frivolous RFIs.

1.03 CONTRACTOR'S REQUESTS FOR INFORMATION

A. When the Contractor is unable to determine from Contract Documents, material, process or system to be installed, Architect will be requested to make clarification of indeterminate item.

1. Whenever possible, such clarification shall be requested at next appropriate project meeting, with response entered into meeting minutes. When clarification at meeting is not possible, because of urgency of need, or complexity of item, Contractor shall prepare and submit RFI to Architect.

B. Contractor shall endeavor to keep number of RFIs to a minimum. In the event the process becomes unwieldy, in the opinion of Architect, because of number and frequency of RFIs submitted, the Architect may require the Contractor to abandon process and submit future requests as either submittals, substitutions or requests for change.

C. RFIs shall be submitted on form acceptable to Architect. Forms shall be completely filled in, and transmitted to Architect via email. Each page of attachments to RFIs shall bear RFI number in lower right corner.

D. RFI's shall be originated by Contractor:
1. RFIs from subcontractors or material suppliers shall be submitted through, reviewed by, and signed by Contractor before submittal to Architect.
2. RFIs sent by subcontractor or suppliers directly to Architect or Architect's consultants shall not be accepted and will be returned unanswered.

E. Contractor shall carefully study Contract Documents to ensure that requested information is not available therein. RFIs which request information available in Contract Documents will be deemed "improper" or "frivolous" as noted above.

F. In cases where RFIs are issued to request clarification of coordination issues, for example pipe and duct routing, clearances, specific locations of Work shown diagrammatically, and similar items, Contractor shall fully lay out suggested solution using drawings or sketches drawn to scale, and submit same with RFI. RFIs which fail to include suggested solution will be returned unanswered with requirement that Contractor submit a complete request.
1. Contractors are encouraged to utilize photocopies of Contract Documents to completely illustrate their questions, and to provide sketches as required to communicate question, concepts and suggestions.

G. Do not use RFIs for following purposes:
1. To request approval of submittals.
2. To request approval of substitutions.
3. To request changes which entail additional cost or credit.
4. To request changes which entail change of time of completion.
5. To request different methods of performing Work than those drawn and specified.

H. In event Contractor believes that clarification by Architect results in additional cost or time, Contractor shall not proceed with Work indicated by RFI until Change Order or Construction Change Directive is prepared and approved in accordance with Section 01 20 00. RFIs shall not automatically justify cost increase in Work or change in project schedule.
1. Answered RFIs shall not be construed as approval to perform extra Work.
2. Unanswered RFIs will be returned with stamp or notation: Not Reviewed.

I. Contractor shall prepare and maintain log of RFIs, and at any time requested by Architect, Contractor shall furnish copies of log showing outstanding RFIs. Contractor shall note unanswered RFIs in log.

J. Contractor shall allow up to 7 days review and response time for RFIs, however, Architect will endeavor to respond in timely fashion to RFIs.

1.04 ARCHITECT'S RESPONSE TO RFIs

A. Architect will respond to RFIs on one of following forms:
   1. Properly prepared RFIs:
      a. If no Change in the Work is required, Architect will respond in space provided on the RFI form.
      b. If a Change in the Work is required, Architect will issue in accordance with Section 01 20 00.
   2. Improper or Frivolous RFIs:
      a. Notification of Processing Fee(s).
      b. Unanswered RFIs will be returned with stamp or notation: "Not Reviewed".

B. Architect may opt to retain RFIs for discussion during regularly scheduled project meetings for inclusion of responses in meeting minutes in lieu of responding on written form.

PART 2 - PRODUCTS

2.01 NOT USED

PART 3 - EXECUTION

3.01 NOT USED

END OF SECTION

ARCHITECT'S
SUPPLEMENTAL INSTRUCTIONS
(Architect's Response to RFI)

RFI No. _____
Date on RFI: _____
Date actually
received by Architect: _____

Copies to

☐ Owner
☐ Contractor
☐ Inspector (Field)

PROJECT: _____

OWNER: _____

Date of Issuance
to the Contractor: _____

TO: _____
(Contractor)

ARCHITECT:

CONTRACT FOR: _____

ARCHITECT'S
PROJECT NO. _____

Conduct the Work in accordance with the following Supplemental Instructions issued in accordance with the Contract Documents without change in Contract Sum or Contract Time. Proceeding with the Work in accordance with these instructions indicates acknowledgement that there will be no change in the Contract Price, Contract Time, or both. If a change in either or both the Contract Sum or Contract Time is anticipated, submit a Change Order Proposal for the Work before proceeding with the change. Submit the CO proposal within 7 days from the date of this response.

Description: _____

Response: _____

Attachments and Clarification Drawings:

Project Architect

END OF SECTION

SECTION 01 30 00

ADMINISTRATIVE REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Project Management and Coordination: Project Coordination, Mechanical and Electrical Coordination, Project Meetings.

B. Construction Progress Documentation: Construction Progress Schedule, Two-week Look Ahead Schedule, Project Website,.

C. Submittal Procedures: Shop Drawings, Product Data, Samples, Source Quality Control Reports, Deferred Approval Items, Finishes Materials Schedule, Coordinated Drawings.
   1. All Submittals shall be via Project Website.

1.02 PROJECT COORDINATION

A. Coordinate scheduling, submittals, and Work of various Sections of Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

B. Verify utility requirements and characteristics of operating equipment are compatible with building utilities. Coordinate Work of various Sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

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

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

E. Coordinate completion and clean-up of Work of separate sections in preparation for Certified Completion and for portions of Work designated for Owner's occupancy.

F. After Owner occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

1.03 MECHANICAL AND ELECTRICAL COORDINATION

A. Carefully coordinate interface between Divisions 21, 22, 23, and Division 26, before submitting any equipment for review or commencing installation.

B. Control Wiring:
   1. Consists of wiring in pilot circuits of contactors and starters, sensors, controllers, relays, and wiring for valve and damper operators.

C. Connections:
   1. Provide connections to controls directly attached to ducts, piping and mechanical equipment with flexible connections.

D. Starters:
   1. Provide magnetic starters or adjustable frequency drives for three phase motors and equipment complete with:
      a. Control transformers.
      b. 120 V holding coil.
      c. Integral hand-off-auto switch.
      d. Auxiliary contacts required for system operation plus one (1) spare.

E. Control Voltage:
   1. Maximum allowable control voltage 120V/208V. Fully protect control circuit conductors in accordance with California Electrical Code.

1.04 PRECONSTRUCTION MEETING

A. Architect will schedule meeting after Notice of Award.

B. Attendance Required: Architect, Prime Contractors, Major Subcontractors, Project Inspector and key Owner personnel.

C. Agenda:
   1. Contract Agreement:
      a. Transmit 5 signed originals of the Agreement to the Owner.
      b. Transmit Attachment Certifications to the Owner.
      c. Transmit Performance and Payment Bonds to the Owner.
      d. Contractor to transmit Certificates of Insurance to the Owner.
      e. Owner to transmit copy of Certificates of Property Insurance to Contractor.
      f. Review General and Supplementary Conditions.
   2. Receive documentation from Contractor:
      a. Construction Progress Schedule.
      b. Schedule of Values.
      c. List of Subcontractors with addresses and phone numbers.
      d. List of Submittals and estimated date of submittal.
   3. Project Administration:
      a. Application for Payment, Stop-Notice Release, Record Drawings.
      b. Change Order Requests, Change Orders, Request For Proposals, Construction Change Directive/Instruction Bulletins. Preparation of Change Orders by Architect according to 2016 California Administrative Code, Code of Regulations Title 24 Part 1, Section 4-233.
      c. Submittals
      d. Substitution procedures.
      e. Site Meetings.
      f. Testing Laboratory.

g. Verified Reports.
h. Phasing.
i. Critical work sequencing and long-lead items.
j. Designation of key personnel and their duties.
k. Lines of communications.
l. Procedures for RFIs.
m. Procedures for testing and inspecting.
n. Distribution of the Contract Documents.
o. Preparation of record documents.
p. Work restrictions.
q. Working hours.
r. Procedures for moisture and mold control.
s. Procedures for disruptions and shutdowns.
t. Construction waste management and recycling.
u. Parking availability.
v. Storage areas.
w. Equipment deliveries and priorities.
x. Security.
y. Progress cleaning.

4. Special Owner Conditions:
   a. Temporary Facilities.
   b. Owner Occupancy.
   c. Work by Owner.
   d. Access to Site – Owner Contact.
5. Construction Process:
   a. Contractor shall discuss overview of construction.
   b. Contractor shall identify items to be selected by Architect/Owner and date selections must be made.
   c. Contractor shall review special requirements for equipment, safety, and noise.
6. Pre-Job Conference:
   a. Prevailing Wage Requirements.
   b. Checklist and signatures.

D. Architect will record minutes and distribute copies within seven days after meeting to participants and those affected by decisions made.

1.05 PROGRESS MEETINGS

A. Architect [Owner's Representative] will schedule and administer meetings throughout progress of Work as needed.

B. Architect [Owner's Representative] will make arrangement for meetings, prepare agenda with copies for participants, preside at meetings.

C. Attendance Required: Project Coordinator, Prime Contractors, Major Subcontractors and Suppliers, Project Inspector, key Owner personnel and Architect as appropriate to agenda topics for each meeting.

D. Agenda:
   1. Review minutes of previous meetings.

2. Review of Work progress.
3. Field observations, problems, and decisions.
4. Identification of problems that impede planned progress.
5. Review of submittals schedule and status of submittals.
6. Maintenance of Construction Progress Schedule.
7. Corrective measures to regain projected schedules.
8. Maintenance of quality and work standards.
9. Effect of proposed changes on progress schedule and coordination.
10. Other business relating to Work.

E. Architect [Owner's Representative] will record minutes and distribute copies within seven days after meeting to participants, and those affected by decisions made.

1.06 PREINSTALLATION MEETING

A. When required in individual Specification Sections, convene pre-installation meeting before starting Work of Section.

B. Require attendance of parties directly affecting, or affected by, Work of specific Section.

C. Notify Architect four days in advance of meeting date.

D. Prepare agenda and preside at meeting:
1. Review conditions of installation, preparation and installation procedures.
2. Review coordination with related Work.

E. Contractor shall record minutes and distribute copies within three days after meeting to participants, Architect and those affected by decisions made.

1.07 SUBMITTAL PROCEDURES

A. Transmit separate request for EACH Section submittal directly to Architect.
1. Include HMC Architects job number as it appears on Contract Documents.
2. Include Authority Having Jurisdiction application or approval number.

B. Submittal number shall use a sequential number followed by a hyphen then the Specification Section followed by a hyphen and then the revision number (e.g., 0001-051200-0). Resubmittals shall have the original number and include the revision number as the suffix (e.g., 0001-051200-1).

C. Identify Project, Contractor, Subcontractor or supplier; pertinent Drawing sheet and detail number(s), and Specification Section number, as appropriate.
1. Provide name telephone number of individual who may be contacted for further information.

D. Apply Contractor's dated stamp with Contractor's original signature or initials affixed thereto, certifying that review, verification of products required, field dimensions, adjacent construction Work, and coordination of information is according to requirements of Work and Contract Documents. Stamped signatures or initials are not acceptable.

E. Schedule submittals to expedite Project. Coordinate submission of related items.
   1. Make submittals according to Construction Schedule and adequate enough in advance of scheduled dates of installation to provide required time for reviews for securing necessary approvals for possible revision and re-submittal and for placing orders and securing delivery.
   2. Schedule submittals such that related materials and assemblies that support or are affected by the submitted materials are either submitted simultaneously or in order of installation sequence such that impacts and coordination can be evaluated as part of the review.
   3. Late submittals, not in accordance with the "Schedule for Submission of Shop Drawings, Product Data and Samples" and the Construction Schedule, will not be considered an acceptable reason for initiating a substitution requests caused by late ordering and procurement of materials.

F. Identify variations from Contract Documents and Product or system limitations that is detrimental to performance of completed Work.

G. Substitutions: Submit only as approved per Section 01 60 00, state effect of approved substitution on construction schedule, and changes required in other work or products.

H. Owner-Directed Substitution Approval: Substitution submittals specifically directed by Owner to be approved by the Architect for this project shall pertain to a specific item only. The Architect's stamped approval of Owner-Directed Substitution does not constitute approval for any other item, other projects or parts of project. A Change Order shall be prepared to effect the Owner's authorization of Owner-Directed Substitution.

I. Provide space for Contractor and Architect review stamps.

J. Revise and resubmit submittals in their entirety, identify changes made since previous submittal.

K. Distribute copies of reviewed submittals to concerned parties. Instruct parties to promptly report any inability to comply with provisions.

L. Determine and verify field dimensions and conditions, materials, catalog numbers and similar data.

M. Coordinate as required with all trades and all public agencies involved.

N. Unless otherwise specifically authorized by Architect, make submittals in groups containing associated items within the same Section. Architect may reject partial submittals as not complying with provisions of this Section.

O. Where individual Sections require structural calculations, prepare submittal under direction of qualified California Licensed Structural Engineer and shall bear the Engineer's stamp and signature.

P. Format of Submittals: Submit Electronic Submittals, including but not limited to Product Data, Shop Drawings, Schedules, Certifications, tests, logs, for ease of information distribution. Identify submitted items that are applicable to the project, including any deviations, with arrows, clouds, or other distinct graphic.
   1. Submit electronic Submittals directly to project website specifically established for the Project.

1.08 CONSTRUCTION PROGRESS SCHEDULE

A. Submit Construction Progress Schedule in duplicate within 15 calendar days after the date on the Notice to Proceed for Architect's review.
   1. Schedule shall reflect amount of time stipulated in Agreement.
   2. If the Contractor proposes an earlier completion dated than stipulated in the Agreement, Change Order will be issued reflecting revised completion date at no change in Contract Sum.
   3. Revise and resubmit as required.

B. Scheduling may utilize programs including: Microsoft Project Schedule, Primavera Project Planner (P3), Primavera SureTrak Project Manager, Meridian Project Systems or similar programs addressing the requirements.

C. Submit computer generated network analysis diagram in accordance with Section 01 32 16.13 using Critical Path Method, generally as outlined in Associated General Contractors of America (AGC) publication "Construction Planning and Scheduling", latest Edition.

D. Indicate complete sequence of construction by activity, identifying Work of separate stages and other logically grouped activities. Indicate early and late start, early and late finish, float dates and duration. Ownership of float time is shared commodity, not for exclusive use by either party. Use float time to make up Work behind schedule until float time is depleted. Submittals returned in less time than allowed by Contract, shall be used to reduce Contractor time extension requests.

E. Indicate Milestones and target date and their activities including completion dates.

F. No Time extensions will be granted nor delay damages paid until a delay occurs that impacts the schedule consumes all available float or contingency time available, and extends the work beyond the contract completion date.

G. Indicate estimated percentage of completion for each item of Work at each submission.

H. Schedule for Submission of Shop Drawings, Product Data and Samples: Incorporate "Schedule for Submission of Shop Drawings, Product Data and Samples" in Construction Progress Schedule. This schedule shall include submittal dates required for shop drawings, product data, samples and product delivery dates, including Deferred Approval Items, if any, and including those items furnished by Owner. Provide time in schedule for Architect's review of submittals according to Contract Time. Allow 21 calendar days for submittals requiring consultants' review.

I. Submit revised schedules with each Application for Payment identifying changes since previous version.

J. As a minimum allow 15 calendar days in schedule for final inspections before final acceptance. Include time to correct punch list items prior to final acceptance.

1.09 TWO-WEEK LOOK AHEAD SCHEDULE

A. Submit a Two Week Look Ahead Schedule and shall contain the following:
1. Prepare detailed two-week schedule projections for the Work to be performed during the following weeks beyond the week it is presented at the weekly construction meeting or at the request of the Architect during the construction period.
2. Be plotted in bar chart or time scale logic format and be of such size that all activity numbers and descriptions are clearly legible.
3. Be sorted by sub contractor responsibility, actual start, early start and total float.
4. Include activity ID, description and float for each activity.
5. Include all activities, completed, in progress and scheduled to start within the time frame of the date minus one week to the data date plus two weeks.
6. Schedule shall be updated and provided at each regular progress meeting for review and comparison to approved project schedule status.

1.10 COORDINATED DRAWINGS

A. Submit drawings that indicate routing, locations sizes, types and number of components in concealed spaces where potential conflict may occur between structures, mechanical, electrical, Automatic Fire Sprinkler System (AFSS), communications and ceiling suspension systems.

B. Indicate locations of ceiling penetrations and surface-mounted items. Provide cross sections at areas to indicate proper support of ceilings and non-interference with work of other Sections of specifications. Cross sections shall indicate coordination required and proposed solutions for routing of elements where potential conflict exists. Reproduction of Architect's reflected ceiling plan is not acceptable.

C. Drawings shall be based on field measurements, shop drawings and product data.

D. Conflicts shall be brought to Architect's attention immediately.

E. Submit to Architect, in writing, requests for clarification or interpretations that will affect intent and/or scope of Contract Documents.

F. Coordinated drawings shall indicate each class of Work in affected area. Drawing or written submittal shall include Contractor's recommendations for solution of any potential conflicts as well as recommendations tendered by any Work of any Section of Specifications which may be affected thereby.

G. Submit coordinated drawings in scale of not less than 1/8" = 1'-0" with necessary sections and profiles at an appropriate, clearly readable enlarged scale. Submit coordinated drawings as one electronic (CD) copy and one bond (hard) copy.

H. Architect will review submittals, make appropriate notations and comments to ensure solution meets intent of Contract Documents and then return to Contractor for implementation.

I. Contractor shall be responsible for proper coordination of Work of Sections of Specifications in execution of coordinated drawings. Installation of materials, components or equipment under one Section of Specifications without full and complete, agreement, knowledge and consent by fabricators of adjacent or otherwise related or affected Work will not be approved.

J. It shall be incumbent upon Contractor that fabricators of Work involved in execution of coordinated drawings be informed, consulted and advised in sufficient advance time to arrive at solutions where no extension of contract time for extra cost to Owner will be approved due to Contractor's negligence in expeditious, timely submittal of coordinated drawings.

1.11 SHOP DRAWINGS

A. Within 15 days from Notice to Proceed, submit to Architect for review and acceptance, "Schedule for Submission of Shop Drawings, Product Data and Samples" (Submission Schedule) listing required submittals and review dates. Schedule shall allow sufficient time for checking by Architect. Incorporate Submission Schedule in Construction Progress Schedule. Days: Calendar Days.
   1. Additionally, submit all Shop Drawings, Product Data and Samples according to the following guidelines. Guidelines are provided to allow Architect and Engineers adequate time for review and is not intended to dictate contractor's means and methods:
      a. Contract of 60 to 90 days: Submit within 15 days from acceptance of Submission Schedule. Allow Architect 15 days to respond (defined as reviewed and returned). Re-submittals: allow contractor 7 days, allow Architect 10 days to respond.
      b. Contract of 90 to 180 days: Submit within 30 days from Notice to Proceed. Allow Architect 15 days to respond. Re-submittals: allow Contractor 10 days, and Architect 15 days to respond.
      c. Contract of 180 to 270 days: Submit within 45 days from Notice to Proceed. Allow Architect 21 days to respond. Re-submittals: allow Contractor 10 days, and Architect 15 days to respond.
      d. Contract of 270 to 360 days: Submit within 60 days from Notice to Proceed. Allow Architect 21 days to respond. Re-submittals: allow Contractor 10 days, and Architect 15 days to respond.
      e. Contract of 360 to 450 days: Submit within 60 days from Notice to Proceed. Allow Architect 21 days to respond. Re-submittals: allow Contractor 15 days and Architect 21 days to respond.
      f. Contract of 450 days and longer: Contractor to schedule submittals. Allow Architect 30 days to respond. Re-submittals: allow Contractor 15 days and Architect 21 days to respond.

B. Submit newly prepared information, drawn to accurate scale. Highlight, encircle or otherwise indicate deviations from Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to Project will not be approved as shop drawings.

C. Shop drawings shall include fabrications and installation drawings, setting diagrams, schedules, patterns, templates and similar drawings. Include following information:
   1. Dimensions
   2. Identification of products and materials included.
   3. Compliance with specified standards.
   4. Notation of coordination requirements.
   5. Notation of dimensions established by field measurement.

D. Sheet Size for print submittals: Except for templates, patterns and similar full-size drawings, submit shop drawings on sheets at least 8-1/2 inch x 11 inch, but not larger than 30 inch x 42 inch.

E. Contractor shall review, stamp with his approval as herein required, and submit with reasonable promptness and in orderly sequence, according to Submittal Schedule, all shop drawings required by Contract Documents or subsequently by Architect as covered by modifications. Shop drawings shall be properly identified. At time of submission Contractor shall inform Architect in writing and with highlighted annotation on shop drawings of any deviation in shop drawings from requirements of Contract Documents.

F. Stamp: Each page of shop drawings shall bear Contractor's stamp, which shall signify Contractor's representation that he has determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and has checked and coordinated information contained in shop drawings. Each stamp shall be accompanied by wet signature or initial of employee of Contractor who may be contacted for information. Stamped signatures or initials are not acceptable.

G. Method of Review: Submit Electronic Shop Drawing Submittals. At Contractor's option he may submit standard printed shop drawings, five (5) prints or bond copies and one (1) 20-lb xerographic bond (reproducible). Identify submitted items that are applicable to the project, including any deviations, with arrows, clouds, or other distinct graphic, or in highlighted writing that can be reproduced with black and white copiers easily discernible from background information.
   1. Comments or corrections will be noted on submittals and returned to Contractor, who shall identify all changes made since previous submittal and resubmit in same manner. When reviewed, submittals will be stamped and returned to Contractor who shall make distribution of electronic copies as required.
   2. Submit electronic Submittals directly to project website specifically established for the Project.

H. Processing Time
   1. Allow enough time for submittal review, including time for re-submittals, as follows:

a. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including re-submittals.
b. In accordance with the Schedule for Submission of Shop Drawings, Product Data and Samples. Review of each submittal for conformance with design concept of Project and with information given in Contract Documents. Architect's review of a separate item shall not indicate acceptance of assembly in which that item functions. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
c. Submittals requiring Consultants' Review: Where review of submittals by Architect's consultants is required, allow minimum 21 calendar days for review of each submittal.

2. Re-submittal Review: In accordance with the Schedule for Submission of Shop Drawings, Product Data and Samples for each re-submittal.

I. Submittal of shop drawings to Architect, shall be made by Contractor with dated transmittal form or letter, and not by subcontractors or suppliers.

J. Architect's review of shop drawings shall not relieve Contractor of responsibility for any deviation from requirements of Contract Documents unless Contractor has informed Architect in writing of such deviation at time of submission and Architect has given written acceptance to specific deviation, nor shall Architect's review relieve Contractor from responsibility for errors or omissions in shop drawings.

K. No portion of Work requiring shop drawings shall be commenced until shop drawings have been returned with review by Architect.

L. At Contractor's option, he may request and if Architect approves use Architect's computer-generated drawings in electronic format. Contractor's request must be in writing with list of drawings requested and CAD format required. Contractor assumes all liability for accuracy of shop drawings if he opts to use Architect's drawings. Software for CAD formats requested by Contractor not currently available to Architect will be provided by Contractor at his own expense. Complete CAD Drawing Request Form at the end of this Section for request.

1. Engineers' Drawings, CAD engineers' drawings are available only at discretion of the Engineer.

1.12 PRODUCT DATA

A. Submit within time required by Shop Drawings.

B. Submit digital shop drawings only..

C. Mark each copy to identify applicable products, models, options and other data. Supplement manufacturers' standard data to provide information unique to this Project.

D. After review, distribute and provide copies for Record Documents.

1.13 SAMPLES

A. Submit within time required by Shop Drawings.

B. Submit samples to illustrate functional and aesthetic characteristics of product with integral parts and attachment devices. Coordinate sample submittals for interfacing Work.

C. Submit samples of finishes from the full range of manufacturers' standard colors, textures and patterns for Architect selections, or in custom colors selected.

D. Include identification on each sample with full Project information.

E. Submit minimum of three (3) samples or as specified in individual Sections of Specifications, one (1) of which will be retained by Architect.

F. Reviewed samples which may be used in the Work are indicated Sections of the Specifications, one (1) of which will be retained by the Architect.

G. Selection or rejection of samples will be determined by Architect in writing.

H. Colors: Materials that are visually related to other finishes require that subcontractors submit their samples before normally scheduled in order that color selection can be made for other items that are scheduled to be ordered earlier in construction schedule. Complete submittal of color charts and color samples shall be made before related colors will be selected Architect. Contractor shall be responsible to coordinate submittal schedules so as not to delay Work.

1.14 FINISHES MATERIALS SCHEDULE

A. Submit in accordance with Submittal Procedures.

B. Submit Schedule verifying lead times of materials and products as scheduled in on the drawings.

1.15 MANUFACTURER'S INSTRUCTIONS

A. When specified in individual Specification Sections, submit manufacturer's printed instruction for delivery, storage, assembly, installation, start-up, adjusting and finishing in quantities specified for product data.

B. Identify conflicts between manufacturer's instructions and contract documents.

1.16 MANUFACTURER'S CERTIFICATIONS

A. When specified in individual Specification Sections, submit manufacturers' certificate to Architect for review in quantities specified for product data.

B. Indicate that material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits and certifications as appropriate.

C. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.

1.17 SPECIAL PROCEDURES - ACCELERATION OF THE WORK

A. If, in judgment of Architect or Owner, it becomes necessary at any time to accelerate Work or portion thereof, Contractor, when ordered or directed by Architect or Owner, shall deploy workers in such portions of Project where directed to enable others to properly engage and carry on their work.
   1. If circumstances require that entire Work or portion thereof be completed at date earlier than Contract Completion Date as adjusted by change orders, Contractor, when ordered or directed by Owner or Architect, shall increase his forces, equipment, hours of work, and/or number of shifts and shall expedite delivery of materials to meet the altered completion date or dates ordered or directed. Any increase in cost to Contractor in compliance with such orders or directives will be adjusted in accordance with Contact Documents.

B. If, in judgment of Architect or Owner, Work is behind schedule and rate of placement of work is inadequate to regain scheduled progress so as to ensure timely completion of Work or separable portion thereof, Contractor, when so informed by Architect or Owner, shall immediately take action to increase rate of Work placement.
   1. This shall be accomplished by any one or combination of following or other suitable measures:
      a. An increase in working forces,
      b. An increase in equipment or tools,
      c. An increase in hours of work or number of shifts,
      d. Expediting delivery of materials.
   2. Contractor shall, within ten (10) calendar days after being so informed, notify Architect of specific measures taken and/or planned to increase rate of progress together with estimate of when scheduled progress will be regained. Should plan of action be deemed inadequate by Architect or Owner, Contractor will take additional steps or make adjustments as necessary to his plan of action until it meets with Architect's or Owner's approval.
   3. Acceleration of Work will continue until scheduled progress is regained. Scheduled progress shall be established from latest revised approved progress schedule for Project.
   4. Timely completion will be understood as Contract Completion Date as revised by all time extensions granted at time acceleration is undertaken.
   5. Contractor shall not be entitled to additional compensation for additional effort he applies to Work under terms of this sub-paragraph.

C. Any directive or order to accelerate Work will be in writing. Any directive or order terminating accelerated Work will be in writing.

1.18 SPECIAL TESTING

A. As required by State Fire Marshal Directive dated April 8, 1986, fire or smoke dampers shall be tested for specified performance in presence of Project Inspector. In event of unsatisfactory performance of any damper unit shall be replaced or repaired and re-tested in presence of Project Inspector at no cost to Owner.

B. Not more than one tenth of fire or smoke dampers in construction up to one hour rated shall be tested for specified performance in presence of representative of State Fire Marshal's Office. Representative will witness activation of fire dampers in 2-hour or greater fire rated construction. In event of unsatisfactory performance of any damper unit shall be replaced or repaired and re-tested in presence of Fire Marshal at no cost to Owner. Random selection of dampers requiring testing shall be as directed by Fire Marshal. Contractor shall be responsible for scheduling and coordinating damper testing procedures.

1.19 PRECEDENCE

A. The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

B. In the event of conflicts or discrepancies among the Contract Documents, interpretations will be based on the following priorities:
1. The Agreement.
2. Addenda, with those of later date having precedence over those of earlier date.
3. The Supplementary Conditions.
4. The General Conditions of the Contract for Construction.
5. Drawings and Technical Specifications.
6. In the case of an inconsistency between Drawings and Specifications or within either Document not clarified by addendum, the better quality or greater quantity of Work shall be provided in accordance with the Architect's interpretation.
7. Any work called for in the Drawings and not mentioned in the Specifications, or vice versa, shall be performed as though fully set forth in both.
8. Contractor shall secure written permission from, Architect before proceeding with work affected by omission or discrepancies in the Contract.

C. Separate sections of this Specification are arranged only for convenience of Contractor, and nothing stated herein should be misconstrued as suggesting jurisdiction over items of work by any different building trades.

1.20 PROJECT WEBSITE

A. Use Contractor's Project Website for purposes of hosting and managing project communication and documentation until Final Completion. Project Website shall include the following functions:
1. Project directory.
2. Project correspondence.
3. Meeting minutes.
4. Contract modifications forms and logs.
5. RFI forms and logs.
6. Task and issue management.
7. Photo documentation.
8. Schedule and calendar management.

9. Submittals forms and logs.
10. Payment application forms.
11. Drawing and specification document hosting, viewing, and updating.
12. Online document collaboration.
13. Reminder and tracking functions.
14. Archiving functions.
15. Submittals.
16. Action Items.
17. Discussion threads.
18. Daily Reports.

B. Provide up to seven Project Website user licenses for use by the Owner's Representative, Owner's Commissioning Authority, Construction Manager, Architect, and Architect's consultants.

C. Upon completion of Project, provide one complete archive copy of Project Website files to Owner's Representative and to Architect in a digital storage format acceptable to the Architect.

D. Provide one of the following Project Website software packages under their current published licensing agreements:
1. Autodesk, Buzzsaw.
2. Autodesk, Constructware.
3. Meridian Systems, Prolog.
4. Submittal Exchange

E. Cost for Project Website software shall be paid by the Contractor . Management of the system, inputting data, training costs is the responsibility of the contractor .

F. Contractor, subcontractors, and other parties granted access by the Contractor to project Web site shall execute a data licensing agreement in the form of an Agreement acceptable to the Owner and Architect.

PART 2 - PRODUCTS

2.01 MOTOR HORSEPOWER - MECHANICAL AND ELECTRICAL COORDINATION

A. In general, motors larger than 1/2 Hp shall be three phase, motors 1/2 Hp or less shall be single phase.

B. Voltage and phase of motors as scheduled on electrical drawings shall take precedence in case of conflict between mechanical and electrical drawings or requirements 2.01 A., above.

C. Under Work of Divisions 21, 22, and 23 shall include coordination of mechanical equipment with requirements of Division 26 before ordering.
1. If motors' horsepower are changed under Work of Divisions 21, 22, and 23 additional electrical cost of change shall be responsibility of Divisions 21, 22, and 23. Increase or decrease motor horsepower from that specified shall not be made without written approval from Architect.

2.02 PRODUCTS FOR PATCHING AND EXTENDING WORK

A. Refer to Section 01 70 00 Execution Requirements.

PART 3 - EXECUTION

3.01 NOT USED.

END OF SECTION

SECTION 01 32 16.13

NETWORK ANALYSIS SCHEDULES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. References

B. Quality Assurance.

C. Format

D. Schedule

E. Submittals

F. Review and Evaluation.

G. Updating Schedule.

H. Distribution

1.02 REFERENCES

A. "Construction Planning and Scheduling", The Associated General Contractors of America (AGC), Washington, D.C., Latest Edition.

1.03 QUALITY ASSURANCE

A. Scheduler: Contractor's Personnel specializing in CPM scheduling with one year minimum experience in scheduling construction Work of complexity comparable to this Project, and having use of computer facilities capable of delivering detailed graphic printout within 48 hours of request.

B. Contractor's Administrative Personnel: One year minimum experience in using and monitoring CPM schedule on comparable projects.

1.04 FORMAT

A. Scheduling may utilize programs (Latest Editions) including Microsoft Project, Primavera Project Planner for Windows (P3), Primavera SureTrack Project Manager, Meridian Project Systems or similar programs addressing the requirements.

B. Listings: Reading from left to right, in ascending order for each activity. Identify each activity with applicable Specification section number.

C. Diagram Sheet Size: 30 inches high by width required.

D. Scale and Spacing: To allow for notations and revisions.

1.05 SCHEDULE

A. Prepare Network Analysis Schedule and supporting mathematical analyses using Critical Path Method, under concepts and methods outlines in AGC's "Construction Planning and Scheduling".

B. Diagrams to illustrate order and interdependence of activities and sequence of Work, how start of given activity depends on completion of preceding activities, and how completion of activity may restrain start of subsequent activities.

C. Illustrate complete sequence of construction by activity, identifying Work of separate stages and other logically grouped activities. Indicate early and late start, early and late finish, float dates and duration. Provide dates for procurement and delivery of critical products and dates for installation and provision for testing. Provide legend for symbols and abbreviations used. Indicate fabrication, delivery and installation activities.

D. Incorporate Schedule for Submission of Shop Drawings and Samples. Submittal dates required for shop drawings, product data, samples and product delivery dates, including those furnished by Owner. Provide time in schedule for review of submittals.

E. Mathematical Analysis: Tabulate each activity of detailed network diagrams, using calendar dates and identifying for each activity:
   1. Preceding and following event number.
   2. Activity description.
   3. Estimated duration of activity, in maximum 15 day intervals.
   4. Earliest start date.
   5. Earliest finish date.
   6. Actual start date.
   7. Actual finish date.
   8. Latest start date.
   9. Latest finish date.
   10. Lag time, total and free float for each activity and critical path.
   11. Monetary value of activity, keyed to Schedule of Values.
   12. Manpower and cost loading of scheduled activities.
   13. Percentage of activity completed.
   14. Responsibility

F. Analysis Program: Capable of compiling monetary value of completed and partially completed activities of accepting revised completion dates and re-computation of all dates and float.

G. Required Sorts: List activities in sorts or groups:
   1. By preceding Work item or event number from lowest to highest.
   2. By amount of float, then in order of early start.
   3. By responsibility in order of earliest possible start date.
   4. In order of latest allowable start dates.
   5. In order of latest allowable finish dates.
   6. Contractor's periodic payment request sorted by Schedule of Values.
   7. Listing of basic input data that generates report.
   8. Listing of activities on critical path.

H. Coordinate contents with Schedule of Values.

I. Contractor shall not sequester float through strategies including extending activity duration estimates to consume available float, using preferential logic, using extensive or insufficient crew or resource loading, use of float suppression techniques, special lead or lag logic restraints or imposed dates.

1.06 SUBMITTALS

A. PRELIMINARY Network Analysis Schedule: Within 15 days after date established in the Notice to Proceed, submit proposed PRELIMINARY Network Analysis Schedule defining planned operations

B. COMPLETE Network Analysis Schedule: Within 10 days after joint review of Draft of proposed COMPLETE Network Analysis Schedule, submit COMPLETE Network Analysis Schedule consisting of network diagrams and mathematical analysis. Include written certification that major, subcontractors have reviewed and accepted proposed schedule.

C. Participate in review of Preliminary and Complete Network Analysis Schedule jointly with Architect.

D. Number of opaque reproductions Contractor requires, plus three copies which will be retained by Architect.

E. All schedule submittals, including progress updates for duration of Work, shall include electronic submittal in original file format, by e-mail or delivered on storage media agreed to.

F. Updated network schedule with each Application for Payment.

1.07 REVIEW AND EVALUATION

A. Participate in joint review and evaluation of network diagrams and analysis with Architect at each submittal.

B. Evaluate project status to determine Work behind schedule and Work ahead of schedule.

C. After review, revise as necessary as result of review and resubmit within 10 days.

1.08 UPDATING SCHEDULE

A. Maintain schedule to record actual start and finish dates of completed activities.
   1. Submit updated schedule at each scheduled project meeting or monthly, whichever is more frequent.

B. Indicate progress of each activity to date of revision with project completion date of each activity. Update diagrams to graphically depict current status of Work.

C. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.

D. Indicate changes required to maintain Date of Certified Completion.

E. Submit sorts required to support recommended changes.

F. Provide narrative report to define problem areas, anticipated delays and impact on Schedule. Report corrective action taken, or proposed and its effect including effect of change on schedule of separate contractors.

1.09 DISTRIBUTION

A. Following joint review, distribute copies of updated schedule to Contractor's project site file, to Subcontractors, Suppliers, Architect, Owner and other concerned parties.

B. Instruct recipients to promptly report, in writing, problems anticipated by projections shown in schedule.

PART 2 - PRODUCTS

2.01 NOT USED.

PART 3 - EXECUTION

3.01 NOT USED.

END OF SECTION

SECTION 01 35 16

ALTERATION PROJECT PROCEDURES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Products and installation for patching and extending Work.

B. Transition and adjustments.

C. Repair of damaged surfaces, finishes and cleaning.

PART 2 - PRODUCTS

2.01 PRODUCTS FOR PATCHING AND EXTENDING WORK

A. New Materials: As specified in products Sections, match existing products and work for patching and extending Work. Maintain fire-rated construction.

B. Type and Quality of Existing Products: Determine by inspection and testing of products where necessary, referring to existing Work as standard.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that demolition is complete and areas are ready for installation of new Work.

B. Beginning of restoration Work means acceptance of existing conditions.

3.02 PREPARATION

A. Cut, move or remove items as necessary for access to alterations and renovation Work. Replace and restore at completion.

B. Remove unsuitable material not marked for salvage, such as rotted wood, corroded metals and deteriorated masonry and concrete. Replace materials as specified for finished Work.

C. Remove debris and abandoned items from work area and from concealed spaces.

D. Prepare surface and remove surface finishes to provide for proper installation of new Work and finishes.

E. Close openings in exterior surfaces to protect existing Work and salvage items from weather and extremes of temperature and humidity. Insulate ductwork and piping to prevent condensation in exposed areas.

3.03 INSTALLATION

A. Coordinate Work of alterations and renovations to expedite completion sequentially and to accommodate Owner occupancy.

B. Remove, cut and patch Work in manner to minimize damage and to provide means of restoring products and finishes to original or specified condition.

C. Refinish visible existing surfaces to remain in renovated rooms and spaces, to specified conditions for each material with neat transition to adjacent finishes.

D. Restore existing systems including fire alarm systems to their full operating condition(s) at no additional cost that were damaged and/or removed during the scope of this contractor's work. Advise Architect of any deficiencies and/or pre-existing deficient conditions prior to starting work.

E. Install products as specified in individual Sections and Drawings.

3.04 TRANSITIONS

A. Where new Work abuts or aligns with existing, perform smooth and even transition. Patch Work to match existing adjacent Work in texture and appearance.

B. When finished surfaces are cut so that smooth transition with new Work is not possible, terminate existing surface along straight line at natural line of division and make recommendation to Architect.

3.05 ADJUSTMENTS

A. Where change of plane of 1/4 inch or more occurs, request instructions from Architect.

B. Trim existing doors as necessary to clear new floor finish. Refinish trim as required.

C. Work at penetrations in fire-rated assemblies to maintain required fire rating assembly.

3.06 REPAIR OF DAMAGED SURFACES

A. Patch or replace portions of existing surfaces that are damaged, lifted, discolored or showing other imperfections. Maintain fire-rated construction.

B. Repair substrate prior to patching finish.

3.07 FINISHES

A. Finish surfaces to match existing.

B. Finish patches to produce uniform finish and texture over entire area. When finish cannot be matched, refinish entire surface to nearest Intersections.

3.08 CLEANING

A. Conform to Division 01, General Requirements and Section 01 70 00, Execution Requirements.

END OF SECTION

SECTION 01 35 42

CALGREEN REQUIREMENTS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section includes general requirements and procedures for compliance with 2016 CALGreen nonresidential mandatory requirements.

B. Related Sections:
   1. Divisions 01 through 33 Sections, as applicable, for CALGreen requirements specific to the work of each of those Sections.

1.02 SUBMITTALS

A. CALGreen submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated CALGreen requirements.

B. Contractor shall develop a spreadsheet or use one furnished by the Architect building department to track submittals required by CALGreen.

C. CALGreen Submittals:
   1. Furnish documentation showing verification of CALGreen compliance as required by enforcing agency.
   2. Section 5.106.1 - Storm Water Loss Prevention Plan: Newly constructed projects and additions which disturb less than one acre of land shall prevent the pollution of stormwater runoff from the construction activities through one or more of the following measures:
      a. Local ordinance, 5.106.1.2.
      b. Best management practices (BMP) complying with Section 5.106.1.2.
   3. Section 5.106.10 - Grading and Paving: Furnish drawing showing grading and paving designed to keep surface water from entering buildings.
   4. Section 5.408.2 - Construction Waste Management Plan: Furnish a construction waste management plan complying with specified requirements.
   5. Section 5.504.4.5 - Composite Wood Products: Furnish documentation showing compliance with Section 5.504.4.5.
   6. Section 5.504.5.6 - Resilient Flooring: Furnish documentation showing resilient flooring materials meet the pollutant emission limits.

1.03 SUMMARY OF CALGREEN REQUIREMENTS

A. Division 5.1 - Planning and Design:
   1. Site Development Requirements: Comply with the applicable requirements of Section 5.106.

a. Section 5.106.1 - Storm Water Pollution Program: Newly constructed projects and additions which disturb less than one acre of land shall prevent the pollution of stormwater runoff from the construction activities through one or more of the following measures:
   1) Local ordinance, 5.106.1.2.
   2) Best management practices (BMP) complying with Section 5.106.1.2.
b. Section 5.106.4 - Bicycle Parking: Comply with Section 5.106.4.1 or 5.106.4.2, as applicable, for short-term and long-term bicycle parking.
c. Section 5.106.5.2 - Designated Parking: Comply with Section 5.106.5.2 for designated parking for low-emitting, fuel-efficient and carpool/van pool vehicles.
d. Section 5.106.8 - Light Pollution Reduction: Comply with Section 5.106.8.1 for outdoor lighting systems.
e. Section 5.106.10 - Grading and Paving: Construction and grading plans shall comply with Section 5.106.10.

B. Division 5.3 - Water Efficiency and Conservation:
1. Section 5.303 - Indoor Water Use: Comply with the applicable requirements of Section 5.303 and Table 5.303.2.2 for Indoor Water Use Baseline.
2. Section 5.304 - Outdoor Water Use: Comply with the applicable requirements of Section 5.304.

C. Division 5.4 - Material Conservation and Resource Efficiency:
1. Section 5.407 - Water Resistance and Moisture Management: Comply with requirements specified in Section 5.407 for Weather Protection and Moisture Control.
2. Section 5.408 - Construction Waste Reduction, Disposal and Recycling: Comply with requirements specified in Section 5.408.
   a. Recycled and/or salvage for reuse a minimum of 50-percent of the nonhazardous construction and demolition waste or meet a local construction and demolition waste management ordinance, whichever is more stringent.
   b. Where the local jurisdiction does not have a construction and demolition waste management ordinance, submit a construction waste management plan with the following:
      1) Identify the materials to be diverted from disposal by efficient usage, recycling, reuse on the Project or salvage for future use or sale.
      2) Determine if materials will be sorted on-site or mixed.
      3) Identify diversion facilities where material collected will be taken.
      4) Indicate the amount of materials diverted, calculated by weight or volume, but not by both.
   c. Utilize a waste management company that can provide verifiable documentation that the percentage of construction and demolition waste material diverted from the landfill complies with Section 5.408.1.2.
   d. The combined weight of new construction disposal that does not exceed 2-pounds per sq. ft. of building area may be deemed to meet the 50-percent minimum requirement.
   e. Documentation shall be provided to the enforcing agency which demonstrated compliance with Section 5.408.1 thru 5.408.1.3. The waste management plan shall be updated as required and shall be accessible during construction for examination by the enforcing agency.

f. 100-percent of trees, stumps, rocks and associated vegetation and soils resulting primarily from land clearing shall be reused or recycled.

3. Section 5.410 - Building Maintenance and Operation: Comply with the requirements specified in Section 5.410.
   a. Provide readily accessible areas that serve the entire building and are identified for the depositing, storage and collection of non-hazardous materials for recycling, including paper, corrugated cardboard, glass, plastics and metals.
   b. For new buildings of 10,000-sq. ft. or more, comply with the commissioning requirements specified in Section 5.410.2. Commissioning shall be performed by trained personnel with experience on projects of comparable size and complexity. General commissioning requirements include the following. The specific requirements of each item are specified in Section 5.410.2.1 thru 5.410.2.6.
      1) Owner's or Owner Representative’s project requirements.
      2) Basis of design.
      3) Commissioning measures shown in the Construction Documents.
      4) Commissioning plan.
      5) Functional performance testing.
      6) Documentation and training.
      7) Commissioning report.
   c. For new buildings less than 10,000-sq. ft., test and adjust systems as specified in Sections 5.410.4.2 thru 5.410.4.5.

D. Division 5.5 - Environmental Quality:
   1. Section 5.504 - Pollutant Control: Comply with the requirements specified in Section 5.504.
      a. The permanent HVAC system shall only be used during construction if necessary to condition the building or areas of addition or alteration within the required temperature range for material and equipment installation. If the HVAC system is used during construction, use return air filters with a minimum MERV of 8.
      b. Cover duct openings and protect mechanical equipment during construction as specified in Section 5.504.3.
      c. Finish materials shall comply with the requirement specified in Sections 5.504.4.1 thru 5.504.4.4, as follows:
         1) Adhesives, adhesive bonding primers, adhesive primers and caulks shall meet the following requirements:
            a) Adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers, and caulks shall comply with local or regional air pollution control or air quality management district rules where applicable or SCAQMD Rule 1168 VOC limits as shown in Tables 5.504.4.1 and 5.504.2.
            b) Aerosol adhesives and smaller unit sizes of adhesives, and sealant or caulking compounds shall comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of CCR Title 17, commencing with Section 94507.

2) Architectural paints and coatings shall comply with VOC limits in Table 1 of the ARB Architectural Coatings Suggested Control Measure, as shown in Table 5.504.4.3 unless more stringent local limits apply.
   a) Aerosol paints and coatings shall meet the PWMIR Limits for ROC in Section 94522(a)(3) and other requirements, including prohibitions on use of certain toxic compounds and ozone depleting substances, ion Sections 94522(c)(2) and (d)(2) of CCR, Title 17, commencing with Section 94520 and in areas under the jurisdiction of the Bay Area Air Quality Management District additionally comply with the percent VOC by weight of product limits of Regulation 8 Rule 49.
3) Carpet shall meet the testing and product requirements of one of the following, as required by Section 5.504.4.4:
   a) Carpet and Rug Institute's Green Label Plus Program.
   b) California Department of Public Health Standard Practice for the testing of VOCs (Specification 01350).
   c) NSF/ANSI 140 at the Gold level.
   d) Scientific Certifications Systems Sustainable Choice.
4) Carpet cushion shall meet the requirements of the Carpet and Rug Institute Green Label program.
5) Carpet adhesive shall meet the requirements of Table 5.504.4.1.
6) Composite wood products, including hardwood plywood, particleboard and medium density fiberboard, used on the interior or exterior of the building shall meet the requirements for formaldehyde as specified in ARB's Air Toxics Control Measure for Composite Wood (17 CCR 93120 et seq.) by or before the dates specified in those sections, as shown in Table 5.504.4.5.
7) For 80% of floor area receiving resilient flooring, installed resilient flooring shall meet at least one of the following:
   a) Certified under the Resilient Floor Covering Institute (RFCI) FloorScore program.
   b) Compliant with the VOC emission limits and testing requirements specified in the California Department of Public Health's 2010 Standard Method for the Testing and Evaluation Chambers, Version 1.1, February 2010.
   c) Compliant with CDPH criteria as certified under the Greenguard Children's & Schools Programs.

d. Provide regularly occupied areas of the building with air filtration media for outside and return air prior to occupancy that provides at least a MERV of 8 as specified in Section 5.504.5.3.
e. Where outdoor areas are provided for smoking, prohibit smoking within 25-feet of building entries, outdoor air intakes and operable windows and in buildings; or as enforced by ordinances, regulations or policies of any city or county, whichever are more stringent. Post signage to inform building occupants of the prohibitions.

2. Indoor Moisture Control: Comply with the requirements specified in Section 5.505.
3. Indoor Air Quality: Comply with the requirements specified in Section 5.506.
4. Environmental Comfort: Comply with the requirements specified in Section 5.507.
5. Outdoor Air Quality: Comply with the requirements specified in Section 5.508.

E. Summary:
   1. Certain CALGreen Measures needed to comply with code are dependent on material selections, documentation and means and methods of the work. Each item related to CALGreen may not be specifically identified as CALGreen requirements in this Section. Refer to CALGreen Code, CCR Title 24, Part 11 for complete descriptions of measures and submittal requirements.
   2. Designate an onsite field staff person contact for all CALGreen prerequisites and credit documentation, subcontractor supervision and submittal coordination and to manage the Contractor's portions of the CALGreen submittal process.
   3. Documentation for CALGreen Measures shall be submitted in the format required by the CALGreen code.
   4. A copy of the CALGreen code, CCR Title 24, Part 11 shall be available on-site at all times.
   5. Additional information on CALGreen can be found at http://www.bsc.ca.gov.

F. Meetings:
   1. Contractor shall conduct CALGreen compliance meetings as required. Contractor personnel who shall attend CALGreen compliance meetings include, but are not limited to:
      a. Contractor's project manager.
      b. Owner's Representative.
      c. Other attendees designated by Owner's Representative.
      d. Subcontractor representatives as appropriate to stage of work.
   2. At a minimum, CALGreen compliance issues shall be discussed at the following meetings:
      a. Preconstruction meetings.
      b. Progress meetings.
      c. Subcontractor meetings.
      d. Meetings shall be scheduled as part of regularly scheduled job meetings on-site.

PART 2 - PRODUCTS

2.01 NOT USED.

PART 3 - EXECUTION

3.01 NOT USED.

END OF SECTION

SECTION 01 40 00

QUALITY REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Reference Standards.

B. Quality Assurance and Control of Installation.

C. Field Samples.

D. Mock-up

E. Project Inspector and Inspections.

F. Permits and Fees.

G. Verified Reports.

H. Manufacturers' Field Services and Reports.

I. Laboratory Testing Services.

1.02 REFERENCE STANDARDS

A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.

B. For products or workmanship specified by Association, Trade or Federal Standards, comply with requirements of standard, except when more rigid requirements are specified or are required by applicable codes.

C. Obtain copies of standards when required by Contract Documents.

D. Maintain copy of standards at jobsite during submittals, planning and progress of the specified Work until Certified Completion.

E. Should specified reference standards conflict with Contract Documents, request clarification from the Architect before proceeding.

F. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.03 QUALITY ASSURANCE/CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, products, services, site conditions and workmanship to produce Work of specified quality.

B. Comply fully with manufacturers' instructions including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

D. Perform Work by persons qualified to produce workmanship of specified quality.

E. Where experience minimums for workmen, applicators, companies or manufacturers are required in individual Sections, written certification and documentation substantiating such minimums shall be submitted and approved by the Architect, when requested.

F. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.

G. Field Samples
   1. Obtain field samples for review by Architect.

H. Mock-Up
   1. Test will be performed under provisions identified in this Section.
   2. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals and finishes.
   3. Where mock-ups are specified in individual Sections, shall be removed after approval per this Section unless are to remain as part of the Work.

1.04 PROJECT INSPECTOR

A. An Inspector, herein referred to as the "Project Inspector", "Job Inspector", or "Inspector of Record" (IOR) will be employed by the Owner approved by the Architect, Structural Engineer, and the Division of State Architect (DSA) in accordance with 2016 California Code of Regulations, Title 24, Part 1, California Administrative Code, Section 4-333(b). The Inspector of Record's duties are described in CAC Sections 4-341(d), 4-342, and DSA Procedure 13-01.

B. Class of Inspector required for this project in accordance with Title 24, Part I, Section 4-333.1.

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

1.05 PERMITS AND FEES

A. Where required by the provisions of individual sections of the Specifications, and where required to carry out construction operations, Contractor shall obtain and pay for permits and fees, including, but not limited to, Demolition, Grading, Disposals, requirements of Water, Gas, Sewer, Flood and Sanitary Districts, Municipal and County Building Departments having jurisdiction.
   1. Fees for final utility connections shall be paid by the Contractor and reimbursed to the Contractor by the Owner at direct cost.
   2. Building Permits or approvals issued by DSA requiring fees will be obtained and paid by the Owner.

1.06 VERIFIED REPORTS

A. Contractor shall comply with CAC Sections 4-336 and 4-343 and issue verified reports through the Architect as required.

1.07 MANUFACTURERS' FIELD SERVICES AND REPORTS

A. When specified in individual Specification Sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment and as applicable and to initiate instructions when necessary.

B. Manufacturers' representatives shall report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

C. Submit report of observation to Architect for review.

1.08 CODES AND REGULATIONS

A. All work pertaining to and all materials supplied for executing and completing this Contract shall comply with provisions specified in the Contract Documents and with all applicable laws, regulations and ordinances governing Work including, but not necessarily limited to, those of:
   1. California Code of Regulations (CCR), Title 24, California Building Standards Code
      a. CAC - 2016 California Administrative Code, 24 CCR Part 1
      b. CBC - 2016 California Building Code, 24 CCR Part 2, Volumes 1 and 2 ('15 IBC w/CA Amendments)
      c. CEC - 2016 California Electrical Code, 24 CCR Part 3 ('14 NEC w/CA Amendments)
      d. CMC - 2016 California Mechanical Code, 24 CCR Part 4 ('15 UMC w/CA Amendments)
      e. CPC - 2016 California Plumbing Code, 24 CCR Part 5 ('15 UPC w/CA Amendments)
      f. 2016 California Energy Code, 24 CCR Part 6

g. CFC - 2016 California Fire Code, 24 CCR Part 9 ('15 IFC w/CA Amendments)
h. CALGreen - 2016 California Green Building Standards Code, 24 CCR Part 11
i. CRSC - 2016 California Reference Standards Code, 24 CCR Part 12

2. California Code of Regulations (CCR), Title 19, Public Safety, Division 1, State Fire Marshal.
3. Food Handling Facilities shall comply with all local health department requirements and California Uniform Retail Food Facilities Law.
4. Addenda Compliance per CBC Section 4-338(b), Part 1.

B. Administrative Regulations, CCR Title 24, Part 1, California Administrative Code, Chapters 1, 4, 5
1. DSA not subject to Arbitration.
2. Copy of Part 1 and Part 2, Volume 1 and 2 (CBC), and Parts 3 through 5 of Title 24 CCR, shall be kept and made available at the construction site office during construction.

C. ADA - Americans with Disabilities Act of 1990, as amended
1. Standards - ADA Title II Regulations and the 2010 ADA Standards for Accessible Design.

D. Enforcement includes all other codes, regulations, or standards referenced in the above listed codes.

E. The preceding listed codes, regulations and ordinances of the regulatory agencies are hereby made a part of this Contract. Nothing in the Contract shall be construed as allowing any violation of any provision of any of above listed documents. Maintain copies of Codes listed above at the construction site.

F. Threaded Steel Anchor Bolts and Anchor Rods requirements: DSA Interpretation of Regulation IR 17-11 requirements for identification, sampling and testing of threaded steel anchor bolts and anchor rods used for anchor structural elements to foundations.
1. Anchor bolt and anchor rod materials identifications, sampling and testing shall be performed in accordance with IR 17-11 and the applicable standards. Anchor bolts and anchor rods not readily identifiable by physical markings, nor traceable by documentation accompanying the material's shipment, shall be treated according:
a. Sampled and tested to established conformity to the project documents.
b. Remove from the jobsite and replaced with identifiable material.
2. Copy of IR 17-11 may be obtained at:
3. www.dgs.ca.gov/dsa/Resources/IRManual.aspx.

G. Should any existing conditions such as deterioration or noncomplying construction be discovered which is not covered by the DSA approved documents wherein the finished work will not comply with Title 24, California Code of Regulations, a construction change document, or a separate set of plans and specifications, detailing and specifying the required repair work shall be submitted to and approved by DSA before proceeding with the repair work.

1.09 VARIATIONS WITH LAWS

A. If Contractor, his subcontractors or suppliers, or any of their employees ascertain at any time that requirements of this Contract conflict with or are in violation of applicable laws, codes, regulations and ordinances he shall not proceed with Work in question, except at his own risk. Contractor shall be required to remove that Work from site and replace such Work with all complying Work at no additional cost to Owner.

1.10 SELECTION AND PAYMENT - TESTING LABORATORY AND SPECIAL INSPECTORS

A. Owner will employ and pay for services of independent Testing Laboratory and Special Inspectors approved by Architect and DSA to perform inspection and testing in accordance with Part 1, Title 24, Section 4-335, California Code of Regulations and this Section.

B. Offsite fabrication requiring Inspection and Testing: submit the qualifications of Inspectors and laboratory, including proposals for services, to the Owner and Architect for approval of qualifications and costs. Inspectors and laboratories shall conform to the requirements of Part 1 Title 24 Section 4-335.

C. Inspector of Record (IOR) / Testing Laboratory Travel Expenses
   1. Initial Testing. For initial testing required by this Manual, Owner shall pay IOR, Testing Laboratory or both, for travel expenses, including mileage, room and board, when travel for inspection and testing of products purchased by the Contractor exceeds 50 miles or 2 hours from the project site.
   2. Additional Testing. When initial testing fails, IOR and Testing Laboratory travel expenses, as described above, attributable to required retesting shall be borne by the Contractor and will be deducted by Change Order from funds due and payable, or that become due and payable to Contractor.
   3. IOR, Testing Laboratory or both, as applicable, shall forward billings and records of such expenses to the Owner.

D. When tests and inspections are required on an overtime basis, initial payment will be made by Owner. At termination of Work or completion of Project, all costs for overtime testing and inspections will be deducted from Contractor's final payment (or any funds due and payable) by Change Order.

E. Before the Testing Laboratory files testing and inspection billings with Owner, they shall be billed indicating segregated straight time from overtime costs. All overtime costs shall be substantiated with detailed explanation for necessity of such work costs.

F. When materials tested fail to meet requirements herein specified, they shall be promptly corrected or removed and replaced, re-inspected and retested in a manner required by the Architect. Costs involved in re-inspection and retesting will be paid by the Owner and deducted from Contractor's final payment (or any funds due and payable) by Change Order.

G. Employment of testing laboratory shall in no way relieve Contractor of obligation to perform work in accordance with requirements of Contract Documents.

1.11 LABORATORY RESPONSIBILITIES

A. Laboratory shall be licensed to conduct testing and inspection operations in California and shall be approved by DSA. It shall be supervised by a State Licensed Civil Engineer who shall certify and sign all reports.

B. Provide qualified personnel at site. Cooperate with Architect, Project Inspector and Contractor in performance of services.

C. Perform specified inspection, sampling and testing of products in accordance with standards specified herein.

D. Ascertain compliance of materials and mixes with requirements of Contract Documents.

E. Promptly notify Architect, Project Inspector and Contractor by letter of observed irregularities or non-conformance of Work or products.

F. Perform additional inspections and test required by Architect or governing agencies.

G. Immediately upon Testing Laboratory determination of a test failure, the laboratory shall telephone the results of test to Architect. On the same day, laboratory shall send written test results to those named on the distribution list below.

1.12 LABORATORY REPORTS

A. After each inspection and test, promptly submit one copy of laboratory report to the following:
   1. Owner
   2. Contractor
   3. Inspector of Record (IOR)
   4. Special Inspectors: Special Inspector's Verified Reports as required by Section 4-336 and shall be submitted in a timely manner.
   5. Architect
   6. Structural Engineer
   7. Mechanical and Electrical Engineers (Related Tests and Inspections).
   8. Division of the State Architect (DSA)

B. Include:
   1. Date issued.
   2. Project title, Architect's number, DSA Application and File number.
   3. Name of inspector.
   4. Date and time of sampling and Specifications Section.
   5. Identification of product and Specifications Section.
   6. Location in the Project.
   7. Type of inspection or tests.
   8. Date of test and ambient conditions at time of test.
   9. Results of tests.
   10. Conformance with Contract Documents.
   11. Signature by Registered Professional Engineer licensed in California.

12. Statement that tests were conducted in accordance with Parts 1 and 2, Title 24, California Code of Regulations.

C. Test reports shall include tests made, whether such tests indicate that the material performed satisfactorily or not. Samples taken but not tested shall be reported. Reports shall show that the materials were sampled and tested in accordance with the requirements of the approved Specifications. Reports shall show the specified design strength and shall state whether or not the materials tested comply with requirements. Report special sampling operations where required.

D. Submit a report verifying that tests and inspections herein specified and otherwise required have been completed and material and workmanship complies with the Contract Documents. Such verification reports shall be submitted at the completion of the Project and at any time the Project is suspended. Parties to receive such reports are the same as listed above.

E. When requested by Architect, provide interpretation of test results.

1.13 LIMITS ON TESTING LABORATORY AUTHORITY

A. Laboratory may not release, revoke, alter or enlarge on requirements of Contract Documents.

B. Laboratory may not approve or accept any portion of the Work.

C. Laboratory may not assume any duties of Contractor.

D. Laboratory has no authority to stop the Work.

E. Laboratory shall not interpret code in relation to the design of the building.

1.14 CONTRACTOR RESPONSIBILITIES

A. Administration of construction by Contractor per CAC Sections 4-330 and 4-343.

B. Deliver to laboratory at designated location, adequate samples of materials proposed to be used which require testing. Selection of materials required to be tested shall be by the Lab or Owner's Representative and not by the Contractor.

C. Cooperate with laboratory personnel, Owner's Representative, Project Inspector and the Architect, and provide access to the Work including weekends and after work hours and to manufacturer's facilities.

D. Provide incidental labor materials and facilities to provide at all times, safe access to Work to be tested, to obtain and handle samples at the site or at source of products to be tested, to facilitate tests and inspections, storage and curing of test samples.

E. Notify Architect, Project Inspector and laboratory 24 hours prior to expected time for operations requiring inspection and testing services. Contractor shall pay for costs incurred if testing or inspections are cancelled and are required to be rescheduled due to the Contractor's failure to notify the Project Inspector in advance as required. Also, notify Owner in advance of manufacturer of materials to allow testing at source of supply.

F. In accordance with CBC-17A, Section 1704A.4, Contractor shall execute and submit a Statement of Responsibility regarding special inspections and testing required for principal wind- and seismic-load bearing systems to the Inspector of Record and the Owner.

G. The Owner, Project Inspector, or the Architect shall have the right to reject materials and workmanship that are defective or to require their correction. Rejected workmanship shall be satisfactorily corrected and rejected materials shall be removed from the premises without cost to the Owner. If the Contractor fails to correct such rejected Work within a reasonable time, fixed by written notice, the Owner will correct same and charge the expense to the Contractor by Change Order.

H. Should it be considered necessary or advisable by the Owner at any time before date of completion of the entire Work to make an examination of Work already completed by removing or tearing out the same, the Contractor shall on request promptly furnish all necessary facilities, labor and materials. If such Work is found to be defective in any respect due to fault of the Contractor or his subcontractor, all extra expenses shall be charged to the Contractor by Change Order. If however such Work is found to meet the requirements of the Contract Documents, the additional cost of labor and materials involved in the examination and for replacement costs shall be allowed to the Contractor by Change Order.

I. When changes of construction schedule are necessary during construction, coordinate such changes with the Testing Laboratory as required.

J. When the Testing Laboratory is ready to test according to the established schedule, but is prevented from testing or taking specimens due to incompleteness of the Work, extra charges for testing attributable to the delay shall be charged to the Contractor by Change Order.

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

L. Selection of materials to be tested shall be made by the Testing Laboratory or the Project Inspector and not by the Contractor.

M. Any material shipped by the contractor from the source of supply prior to having satisfactorily passed such testing and inspection or prior to the receipt of notice from said representative that such testing and inspection will not be required, shall not be incorporated in the Work.

1.15 MOISTURE AND ALKALINITY, AND RELATIVE HUMIDITY TESTING

A. Field Testing of concrete slabs, moisture testing per ASTM F1869 -2009. The test area should be at the same temperature and humidity expected during normal use, minimum testing conditions shall be 75± 10 degrees F. and 50± 10% relative humidity. Maintain these conditions 48 hours prior to, and during testing.

B. Field Testing of concrete slabs, relative humidity per ASTM F2170.

C. Field Testing of concrete slabs, resilient flooring per ASTM F710.

D. Alkalinity testing: per ASTM F710, ranges shall not exceed those recommended by the flooring manufacturer.

PART 2 - PRODUCTS

2.01 NOT USED.

PART 3 - EXECUTION

3.01 ATTACHMENTS

A. Form DSA-103, Statement of Structural Tests and Inspections.

END OF SECTION

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Temporary Utilities: Electricity, lighting, heat, ventilation, water and sanitary facilities.

B. Temporary Controls: Barriers, enclosures, fencing, protection of Work and security.

C. Construction Facilities: Access roads, progress cleaning, project sign, and field office trailer.

D. Comply with Title 24, Part 9, California Fire Code, Chapter 33 Fire Safety During Construction and Demolition, during all Phases of project.

E. INTERIM LIFE SAFETY MEASURES (ILSM) requirements in this Section.

1.02 SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

1.03 TEMPORARY ELECTRICITY

A. Connect to existing power service. Power consumption shall not disrupt Owner's need for continuous service.

B. Contractor shall pay cost of energy used. Exercise measures to conserve energy. Contractor to cooperate with Owner in ascertaining prorated cost of energy used for his portion of Work.

C. Provide power outlets for construction operations with branch wiring and distribution boxes located where needed. Provide flexible power cords as required.

D. Provide feeder switch at source distribution equipment.

E. Permanent existing convenience receptacles may not be utilized during construction.

1.04 TEMPORARY LIGHTING

A. Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

B. Maintain lighting and provide routine repairs.

C. Permanent building lighting may be utilized during construction.

D. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system. Provide 20 foot candles minimum lighting levels inside building(s), and 5 foot candles outside for safety and security; provide site night lighting with capability to illuminate entire site.

1.05 TEMPORARY HEAT

A. Provide heating devices and heat as required to maintain specified conditions for construction operations.

B. Contractor shall pay cost of energy used. Exercise measures to conserve energy.

1.06 TEMPORARY VENTILATION

A. Ventilate enclosed areas to assist cure of materials to dissipate humidity and noxious fumes and to prevent accumulation of dust, fumes, vapors or gases.

1.07 TELEPHONE SERVICE

A. Provide, maintain and pay for two separate telephone service lines and telephone service to field office and Project Inspector's field office at time of project mobilization. Project Inspector's telephone shall be equipped with exterior, clearly audible bell.

B. Provide "Fax" facility at worksite.

C. Provide answering machine.

D. Provide, maintain, and pay for copy machine with 11 by 17 inch capability.

1.08 TEMPORARY WATER SERVICE

A. Connect to existing water source for construction operations.

B. Contractor shall pay cost of water used. Exercise measures to conserve water.

C. Extend branch piping with outlets located so water is available by hose with threaded connections.

1.09 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Existing facilities shall not be used.

1.10 TEMPORARY FIRE PROTECTION

A. Provide fire protection during construction according to CFC Chapter 33, including but not limited to fire extinguisher requirements and exit access requirements.

B. Conform to Title 24, Part 9, California Fire Code, Chapter 33, Fire Safety During Construction/Demolition.

1.11 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

B. Provide barricades required by governing authority for public rights-of-way and for public access to existing facilities.

C. Protect non-owned vehicular traffic, stored materials, site and structures from damage.

D. Provide steel trench plates, orange mesh fencing, construction site marker and other protective means to keep site and users, Owner's personnel, visitors and students safe, protected, and separated from ongoing construction operations. Provide temporary access at all paths of travel. Yellow warning tape is not acceptable means of separation and protection. At all open trenching operations, enclose entire trenching operation area including stockpiled backfill within orange mesh construction fencing. Provide steel trench plate "bridges" at all walkways.
   1. Allow Fire Marshall access at reasonable times during progress of the work for inspections.

1.12 FENCING FOR CONSTRUCTION OPERATIONS

A. Construction: Commercial grade chain link fence, [removable panels], 1-3/4 inch mesh, 11 gauge, top and bottom knuckled selvage (closed end).
   1. Provide screen full height of fence, 1-3/4 inch mesh, 11 gauge, woven open mesh 100% polypropylene with 78 percent wind break, reinforced tape at grommets at 18 inches centers at perimeter, attach screen to chain link fence with 11 gauge hog rings by Roxford Fordell, Los Angeles, CA.

B. Provide 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks.

C. Submit detailed fencing and construction traffic plan for review and approval by Architect.

1.13 STAGING AREAS

A. Coordinate with Owner for location, extent and type of construction staging area.

1.14 INTERIOR ENCLOSURES

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

B. Construction: Wood framing , plywood or gypsum board sheet materials with closed joints and sealed edges at intersections with existing surfaces, translucent or opaque as directed by Owner.

C. Accessories Sets as required: ZIPWALL Dust Barrier System, Arlington, MA. ZipWall SLP: Springloaded Poles, Foam Rails, Side Clams, GripDisks, “Zip-Up” Self-Adhesive Zippers, ZipWall Magnetic Door.

D. Paint surfaces exposed to view from Owner-occupied areas where required for rigid wall construction.

1.15 PROTECTION OF INSTALLED WORK

A. Protect installed Work and provide special protection where specified in individual Specification Sections.

B. Provide temporary and removable protection for installed products. Control activity in immediate work area to minimize damage.

C. Provide protective coverings at walls, projections, jambs, sills and openings. Provide protective and removal coverings for metal finishes intended to be exposed.

D. Protect finished floors and other surfaces from traffic, dirt, wear, damage or movement of heavy objects by protecting with durable sheet materials.

E. Prohibit traffic or storage upon waterproofed or roofed surfaces.

F. Prohibit traffic from landscaped areas.

1.16 SECURITY

A. Provide security and facilities to protect Work, existing facilities and Owner's operations from unauthorized entry, vandalism or theft.

B. Coordinate with Owner's security program.

C. Within 48 hour period, replace or repair, to Architect's satisfaction, all surfaces or items damaged by graffiti during course of construction.

D. Where security or fire detection systems are disabled for any reason, including where Owner has given approval for such system shutdown, provide fire watch or security guard service as directed by Owner at no additional cost to Owner.

1.17 ACCESS

A. Provide and maintain access to fire hydrants, free of obstructions. Where required by local fire authority, provide and maintain a 26 foot wide fire apparatus access road.

B. Provide means of removing mud from vehicle wheels before entering streets.

C. Designated existing on-site roads may be used for construction traffic.

D. Where construction traffic occurs when students [public] and staff are on campus [site], provide "spotter" responsible for leading construction traffic through site areas.

E. Route construction equipment, trucks, and similar vehicles via existing public streets to and from site as approved by governing authorities.

1.18 PARKING

A. Arrange for temporary parking areas to accommodate construction personnel.

B. When site space is not adequate, provide additional off-site parking.

1.19 PROGRESS CLEANING

A. Refer to Section 01 70 00 Execution Requirements and the requirements of this Section.

B. Maintain areas free of waste materials, debris and rubbish. Maintain site in a clean and orderly condition.

C. Remove debris and rubbish from closed or remote spaces, prior to enclosing space.

D. Broom and vacuum clean interior areas prior to start of surface finishing and continue cleaning to eliminate dust. Clean substrate; remove dirt, oil, grease, construction markings, and foreign matter that could adversely affect surface finish appearance or performance.

E. Remove waste materials, debris and rubbish from site weekly and dispose off-site.

F. Maintain public streets free of mud, dust and debris and as required by jurisdictional authority.

1.20 PROJECT SIGNAGE AND BANNERS

A. Provide project sign, as designed by Architect. Fabricate using exterior-grade plywood and wood frame construction, acrylic painted with exhibit lettering by professional sign painter.
   1. List title of Project, names of Owner and State of California Office of Public School Construction, Architect and Contractor.
   2. Erect on site at locations established by mutual agreement of Owner, Architect and Contractor.

B. Provide and install signage to provide directional, identification, and contact information to construction personnel and visitors as follows:
   1. For construction traffic control/flow at entrances/exits; provide STOP signs at all exit points.
   2. To direct visitors.
   3. For construction parking.
   4. For Warning Signs as required.
   5. Per CAL/OSHA standards as necessary.
   6. Emergency contact information and phone number of local police, fire, and emergency personnel.

C. Except for signs required by law, no other signs will be permitted without express written permission from Architect. Signs required by law may not obscure any of the banners.

1.21 FIELD OFFICE TRAILER(S)

A. Contractor's Field Office Trailer: Provide field office trailer, weather tight with lighting, electrical outlets, communications capabilities, heating, cooling and ventilating equipment and equipped to adequately conduct meetings for construction operations, minimum size; 480 sq. ft. Provide restroom: facilities within trailer, plumb sanitary facilities inside trailer. .

1. In SAME Contractor's Field Office Trailer provide separate private office similarly equipped and furnished with desk, 2 drawer file cabinet, a table and two chairs for use by Project Inspector, Owner and Architect, including plan rack suitable for 30 by 42 inch drawings, minimum size 120 square feet. Office must be lockable and have direct access to outside, provide private telephone line and access to the Internet.

B. Cost of use permits, occupancy permits and related fees, if any required by Governing Authorities for temporary construction facilities, shall be paid by Contractor.

C. Provide 4 by 8 feet conference table, 6 conference chairs and 3 by 6 feet white markerboard at conference room.

D. Install no closer than 45 feet from project buildings in accordance with NFPA 241.

E. Maintain facility until Substantial Completion of entire project. Remove within 1 week of Substantial Completion.

F. Provide property insurance and protection.

1.22 REMOVAL OF UTILITIES, FACILITIES AND CONTROLS

A. Remove temporary above grade or buried utilities, equipment, facilities, materials prior to Certified Completion inspection.

B. Remove temporary underground or overhead installations.

C. Clean and repair damage caused by installation or use of temporary Work.

D. Restore permanent facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

1.23 RELOCATION OF UTILITIES

A. Contractor shall not have responsibility of timely removal, relocation or protection of public utility facilities that are not identified by Owner in Drawings and Specifications, in accordance with California Government Code 4215. Owner shall compensate Contractor for costs of locating and repairing damage not due to failure of Contractor to exercise reasonable care in removing and relocating such public utility facilities. If Contractor, while performing Contract, discovers public utility facilities not identified by Owner in Contract Drawings or Specifications, he shall immediately notify Owner and utility in writing. Contractor shall not be assessed liquidated damages for delay when delay was caused by failure of Owner to provide for relocation for utility facilities.

1.24 WATER CONTROL

A. Do not permit surface, rainwater or subsurface water or other liquids to accumulate in or about premises and vicinity thereof. Should such conditions be encountered or develop, control water or other liquid shall be suitably disposed of by means of temporary pumps, piping, drainage lines, troughs, ditches, dams or other methods as reviewed by Architect and approved by authority having jurisdiction.

B. Dewatering Facilities and drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations and construction free of water.

C. Dispose of rainwater in lawful manner that will not result in flooding Project or adjoining properties nor endanger permanent Work or temporary facilities.

1.25 DUST CONTROL

A. Conduct earthwork operations in a manner to prevent windblown dust and dirt from interfering with progress of Work, Owner's activities and existing occupied structures in areas immediately adjacent as well as adjacent properties.

B. Periodically water construction areas as required minimizing accumulation of dust and dirt.

C. Water spray or cover with tarpaulins truck loads of soil to additionally minimize generation of dust and dirt from construction operations.

D. Prevent dust and dirt from accumulating on walks, roadways, parking areas and from washing into sewer and storm drain lines.

1.26 EROSION AND SEDIMENT CONTROL

A. Plan and execute construction by methods to control surface drainage from cuts and fills from borrow and waste disposal areas. Prevent erosion and sedimentation.

B. Minimize amount of bare soil exposed at one time.

C. Provide temporary measures such as berms, dikes and drains to prevent water flow over adjacent properties or City rights-of-way.

D. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.

E. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

1.27 NOISE CONTROL

A. Avoid excessive noise where adjacent Owner's functions may be detrimentally affected.

B. Refer to requirements in Section 01 57 20, Control of Construction Noise.

1.28 POLLUTION CONTROL

A. Provide methods, means and facilities to prevent contamination of soil, water and atmosphere from discharge of noxious, toxic substances and pollutants produced by construction operations.

B. Burning of refuse, debris or other materials will not be permitted on Site.

C. Comply with regulatory requirements and anti-pollution ordinances during course of construction and disposal operations.

1.29 WASTE DISPOSAL FACILITIES

A. Comply with requirements of Authorities Having Jurisdiction. Remove loose refuse and dispose off site legally.

B. Provide waste-collection containers in sizes adequate to handle waste from construction operations.

C. Provide and maintain trash bins on the Project site. Trash bins shall be serviced on an as needed basis.

D. Free Fall Maximum: 8 ft. Provide enclosed waste CHUTES for higher fall.
   1. Provide disposals sufficiently sized to prevent debris from scattering around areas.
   2. Use support systems, intake hoppers, protective liners and durable non-breakable chutes. Max-Access Inc., Houston, TX, Chutes International, White Plains, MD or equal.
   3. When using demolition chutes, chute opening must be sealed when not in use. Chute and dumpster shall be sprayed with water to maintain dust control.
   4. Do not use Owner's disposal system.

1.30 PROTECTION OF EXISTING FACILITIES AND SITEWORK

A. Provide site plan of proposed route of construction equipment for approval by Owner.

B. Use caution to minimize disturbance and damage to existing landscaped areas and sitework.

C. Protect sidewalks, curbs, entry areas and utilities.

D. The Contractor shall preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) and irrigation on or adjacent to the work site, which are not to be removed and which do not unreasonably interfere with the work required under this contract. The Contractor shall only remove trees when specifically authorized to do so, and shall avoid damaging vegetation that will remain in place. If any limbs or branches of trees are broken during contract performance, or by the careless operation of equipment, or by workmen, the Contractor shall trim those limbs or branches with a clean cut and paint the cut with a tree-pruning compound as directed by the Contracting Officer.

E. Protect from damage all existing improvements and utilities at or near the work site and on adjacent property of a third party, the locations of which are made known to or should be known by the Contractor. Repair any damage to those facilities, including those that are the property of a third party, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in performing the work.

F. Repair landscaped areas, irrigation and sidewalks and any other damaged facilities where trucks, erection equipment or other construction equipment was used in removal and replacement of the HVAC units during construction. Repair damaged areas to match existing construction to satisfaction of the Owner, and at no additional cost to the Owner.

1.31 CONTRACTOR CONDUCT AND DRESS CODE

A. Contractor's and subcontractors' personnel shall observe and abide by Owner requirements concerning appropriate conduct, loud noise (unrelated to construction activities) and dress requirements for a safe and un-disturbing work place. Conduct work activities in a professional manner at all times.

B. Dress Code requirements: contractor’s personnel shall wear traditional work attire or uniforms without logos, graphics or wording detrimental to work [school] environment; unless logos, graphics or wording are for business identification purposes.

C. Contractors and subcontractors shall wear orange safety vests along with other required safety attire including hard hats and safety glasses.

D. Identification badges issued by the Owner shall be worn at all times, worn on the left side shirt-pocket area, displayed in full view and not concealed.

E. No radios permitted on the job site.

F. Owner reserves the right to remove any person(s) not observing conduct and dress requirements specified herein.

G. Animals: Contractors' and workers' pets or animals of any kind are not permitted on the Campus, including being retained in a vehicle.

1.32 WORK RESTRICTIONS - COORDINATION WITH OCCUPANTS, PEDESTRIAN AND VEHICULAR TRAFFIC

A. During the course of construction provide the following traffic controls:
   1. Provide signs with arrows and text direction pedestrian traffic. Signs, exterior grade: aluminum metal, 0.125" thick with distinct graphics, and lettering not less than 1" high Helvetica Medium. Mounting on walls, fencing or 2" x 2" galvanized steel post.
   2. Provide shop drawing of layout and design to District for approval.
   3. Install crosswalk at locations where existing crosswalks are obstructed by construction operations.
   4. Vehicle Control: Assign flagman or contractor's personnel in distinct orange safety vests and hard hats to direct vehicular traffic flow of parents' vehicles during student drop-off and pick-up times. Assign not less than 2 persons per control point for directing traffic. Supply District with the names of persons involved.
   5. Pedestrian Control: Assign contractor's personnel in distinct orange safety vests and hard hats directing pedestrian traffic flow during drop-off and pick-up times. Assign not less than 2 persons per control point for directing traffic.
   6. Coordinate with District and school site administrators on daily drop-off and pick-up times as they change throughout the school year.

B. Removal
   1. Remove equipment and devices when no longer required.
   2. Repair damage caused by installation.
   3. Reinstall original crosswalks, signs, landscape construction to original condition.

1.33 MOBILIZATION AND DEMOBILIZATION

A. The work consists of the mobilization and demobilization of the contractor's forces and equipment necessary for performing the work required under the Contract. It does not include mobilization and demobilization for specific items of work for which payment is provided elsewhere in the Contract. Mobilization will not be considered as work in fulfilling the Contract requirements for commencement of work.

B. Mobilization - Equipment and Material: Mobilization shall include all activities and associated costs for transportation of contractor's personnel, equipment, and operating supplies to the site; establishment of offices, buildings, and other necessary general facilities for the contractor's operations at the site; premiums paid for performance and payment bonds including coinsurance and reinsurance agreements as applicable.

C. Demobilization shall include all activities and costs for transportation of personnel, equipment, and supplies not required or included in the contract from the site; including the disassembly, removal, and site cleanup of offices, buildings, and other facilities assembled on the site specifically for this Contract.

D. This work includes mobilization and demobilization required by the Contract at the time of Award. If additional mobilization and demobilization activities and costs are required during the performance of the Contract as a result of changed, deleted, or added items of work for which the contractor is entitled to an adjustment in Contract Price, compensation for such costs will be included in the price adjustment for the item or items of work changed or added.

E. Payment: Payment will be made as the work proceeds, after presentation of paid invoices or documentation of direct costs by the contractor showing specific mobilization and demobilization costs and supporting evidence of the charges of suppliers, subcontractors, and others. When the total of such payments is less than the lump sum Contract Price, the balance remaining will be included in the final Contract payment. Payment of the lump sum Contract Price for mobilization and demobilization will constitute full compensation for completion of the work.

F. Payment will not be made under this item for the purchase costs of materials having a residual value, the purchase costs of materials to be incorporated in the project, or the purchase costs of operating supplies.

1.34 INTERIM LIFE SAFETY MEASURES (ILSM)

A. The Interim Life Safety Measures (ILSM) itemized below are a series of administrative actions that must be taken to compensate for the hazards posed by NFPA 101 - 2003 Life Safety Code (LSC) deficiencies temporarily caused by construction activities. In addition, the ILSM shall include all applicable sections of NFPA 241, Safeguarding Construction, Alteration, and Demolition Operations, a copy of which shall be maintained at the site by the Contractor for reference.

B. ILSM must be implemented in, or adjacent to, all construction areas within the scope of work of this contract. ILSM apply to all construction personnel, including personnel of the General Contractor, Sub-contractors, Vendors, Suppliers, and any other personnel under the supervision and coordination of the General Contractor. ILSM shall be continuously enforced by the Contractor throughout the duration of the Contract. The Contractor shall comply with all the ILSM and shall be responsible and liable for the consequences of failing to comply, including a Type 1 Deficiency issued by the Joint Commission on Accreditation of Health Organization (JCAHO) and the loss of the Owner's JCAHO accreditation.

C. The Contractor shall ensure that exits provide free and un-obstructive egress.
   1. Unless provided elsewhere, the Contractor shall provide a Construction Egress Plan, showing temporary barricades, egress paths, and exits from, around, and (if necessary through) the construction area. Temporary exits shown on the Plan must be identified with exit signs approved by the local authority having jurisdiction.
   2. The Contractor shall present the Plan to and obtain approval from the Owner and the local authority having jurisdiction prior to implementation.

3. The Contractor, in conjunction with the Owner, shall conduct an ILSM meeting prior to the commencement of the work. The purpose of the meeting will be to present the Construction Egress Plan and to review the ILSM. The meeting shall be attended by the Owner's and the Contractor's designated personnel. The Contractor is responsible to present the ILSM to all personnel under his supervision and coordination, whether or not they attend the ILSM meeting.
4. The Contractor shall update and revise as required by construction progress and phasing.
5. The paths of egress and exits shown on the Plan must be inspected daily and maintained at all times.
6. Where temporary alternate exits cannot be provided, the Contractor shall provide a continuous, 24 hour per day Fire Watch, consisting of one designated person per floor assigned solely to observing and reporting fire and life safety conditions and hazards to the General Contractor and the Owner, as well as initiating any required code red alarms.

D. The Contractor shall ensure free and unobstructed access to emergency departments and services for emergency forces.

E. The Contractor shall ensure that fire alarm, detection, and suppression systems, as well as structural and compartmentation features of fire safety outside the construction area are not impaired or compromised.
1. When the existing fire systems or fire safety features outside the construction area must be impaired or compromised a temporary but equivalent system or feature shall be provided. All temporary systems must be tested and inspected monthly.
2. In lieu of temporary systems or features, the Contractor may provide a Fire Watch as described in Item C.6 above and other measures as required by the authority having jurisdiction.

F. The Contractor shall ensure that temporary construction barricades and barricade doors are smoke tight and made of non-combustible or limited combustible materials that will not contribute to the development of smoke or fire.

G. The Contractor shall provide additional fire-fighting equipment and user-training for his personnel.

H. The Contractor shall ensure the prohibition of smoking by his personnel in accordance with MA.1.3.15 of the "Management and Administrative Service" manual, Volume 1, a copy of which shall be provided to the Contractor by the Owner.

I. The Contractor shall develop and enforce storage and debris-removal practices that reduce the flammable and combustible fire load of the construction area to the lowest level necessary for daily operations.

J. The Contractor shall conduct a minimum of one fire drill every month throughout the duration of the project.

K. The Contractor shall provide daily hazard surveillance of the construction area with special attention to excavations, construction storage, and field offices.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Materials for temporary work may be new or used.
   1. Use materials that are adequate in capacity for the required use and loads.
   2. Do not use materials that would create unsafe conditions.
   3. Do not violate requirements of authorities having jurisdiction.

B. Electrical Materials
   1. Power Receptacles: 15 ampere, 120 volt, duplex grounding type with ground fault circuit interrupters. Furnish in suitable boxes with hinged cover plates.
   2. Light Fixtures and Lamps: Medium-base, rubber pigtail, type lamp sockets or porcelain lampholders furnish with boxes, and lamps.
   3. Conductors: insulated copper or aluminum, with phase conductor insulation rated for the circuit voltage, and insulation or jacketing suitable for the conditions, and branch circuit conductors - No. 12 AWG minimum size, except No. 10 AWG where length of branch circuit exceeds 100 feet.

C. Mechanical Materials
   1. Portable Equipment may be new or used, temporary units that will not damage construction materials or processes, that will not create unhealthy conditions for workers, and that can be operated with approval from the authorities having jurisdiction.
   2. Fixed Equipment may be new or used, temporary or permanent, devices including any heat generating or cooling equipment that can be operated in a safe manner and with approval from the authorities having jurisdiction.
   3. Fuel. Use only devices that burn either natural gas or fuel oil.
      a. Store fuel oil in portable tanks with a 60 gallon maximum capacity, located on the same level as the devices, and equipped with fills and vents outside the enclosed space.
      b. Locate the tanks a minimum of 10 feet from heating devices. Label tanks with proper type of fuel.
      c. Diesel engines: no equipment/engine modification required for B20 biodiesel.

PART 3 - EXECUTION

3.01 REMOVAL

A. Remove all temporary control measures in accordance with regulatory requirements at completion of construction.

END OF SECTION

SECTION 01 55 00

VEHICULAR ACCESS AND PARKING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Signs, Signals and devices.

B. Construction Parking Control.

C. Flagmen

D. Flares and Lights.

E. Haul Routes.

F. Traffic Signs and Signals.

G. Removal

1.02 SIGNS, SIGNALS AND DEVICES

A. Post-Mounted and Wall-Mounted Traffic Control and Informational Signs as required to maintain adequate standards of safety and control of vehicular movement on and off construction site.

B. Traffic Control Signals: As approved by local jurisdictions.

C. Traffic Cones and Drums, Flares and Lights: As approved by local jurisdictions.

D. Flagmen Equipment: As approved by local jurisdictions.

1.03 CONSTRUCTION PARKING CONTROL

A. Control vehicular parking to prevent interference with public traffic and parking, access by emergency vehicles and Owner's operations.

B. Monitor parking of construction personnel's vehicles. Maintain vehicular access to and through parking areas.

C. Prevent parking on or adjacent to access roads or in non-designated areas.

1.04 FLAGMEN

A. Provide trained and equipped flagmen to regulate traffic when construction operations or traffic encroach on public traffic lanes.

1.05 FLARES AND LIGHTS

A. Use flares and lights during hours of low visibility to delineate traffic lanes and to guide traffic.

1.06 HAUL ROUTES

A. Consult with authority having jurisdiction in establishing public thoroughfares to be used for haul routes and site access.

B. Confine construction traffic to designated haul routes.

C. Provide traffic control at critical areas of haul routes to regulate traffic, to minimize interference with public traffic.

D. Consult with Owner to establish construction traffic haul route on existing campus.

1.07 TRAFFIC SIGNS AND SIGNALS

A. At approaches to site and on site, install at crossroads, detours, parking areas and elsewhere as needed to direct construction and affected public traffic.

B. Install and operate traffic control devices as are necessary to direct and maintain orderly flow of traffic in areas under Contractor's control and areas affected by Contractor's operations.

C. Relocate as Work progresses to maintain effective traffic control.

1.08 REMOVAL

A. Remove equipment and devices when no longer required.

B. Repair damage caused by installation.

C. Remove post settings to full depth.

PART 2 - PRODUCTS

2.01 NOT USED.

PART 3 - EXECUTION

3.01 NOT USED.

END OF SECTION

SECTION 01 57 20

CONTROL OF CONSTRUCTION NOISE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 01 Specification sections, apply to work of this section.

1.02 DESCRIPTION

A. This section specifies the control of noise arising from construction operations and associated activities. Noise control measures specified are an obligation of the Contractor with the costs included within the various contract items of work.

1.03 QUALITY ASSURANCE

A. Establish and maintain quality assurance program for the control of noise.

1.04 SUBMITTALS

A. Noise Control Plan: After the contract is awarded, prior to the commencement of the Work, the Contractor shall meet with the Owner to discuss the proposed Noise Control Plan and to develop mutual understanding relative to details of the Plan.
   1. The Noise Control shall comply with the constraints set forth by the Owner, and be in compliance with the noise control regulations of the Owner and the City of Escondido.
   2. Submit a description of the instruments to be used in monitoring noise.
   3. Show the areas and boundaries where noisy work will occur.
   4. Approval of the Contractor's Noise Control Plan will not relieve the Contractor of responsibility for proper and continuing control of noise throughout the project site.

1.05 NOISE CONTROL

A. General: Take every practicable precaution and action to eliminate or minimize noise emanating from the construction operations.

B. Timing: Perform noise-producing work in less-sensitive hours of the day or week as directed by the Owner.

C. Constraints: Control and abate noise produced by the Work at or below the decibel levels and within the time periods specified.
   1. Repetitive, high level impact noise will be permitted only between normal construction time specified in Section 01 10 00 Summary of Work unless otherwise permitted by the Owner. Repetitive impact noise on the property shall not exceed the following dB limitations:

Time Duration of Impact Noise	Sound Level in dB

More than 12 minutes in any hour	70
Less than 30 seconds of any hour	85
Less than three minutes of any hour	80
Less than 12 minutes of any hour	75

2. Provide equipment, sound-deadening devices, and take noise abatement measures that are necessary to comply with the requirements specified, and comply with the following:
   a. Maximum permissible construction equipment noise levels within 50 feet of any building on the premises shall be 75 decibels.
   b. Provide shields or other physical barriers to restrict the transmission of noise.
   c. Provide soundproof housings or enclosures for noise-producing machinery.
   d. Use intake and exhaust mufflers on internal combustion engines that are maintained to have equipment perform below noise levels specified.
   e. Line hoppers and bins with sound deadening material.
   f. Conduct truck loading, unloading and hauling operations so that noise is kept to a minimum.

D. At least once every five successive working days while work is being performed, above 55 dBA noise level, measure sound level for noise exposure due to the construction. Measure noise exposure at the property line or 50 feet from the noise source, whichever is greater. Measure the sound levels on the A weighing network of a General Purpose sound level meter at slow response. To minimize the effect of reflective sound waves at buildings, measurements may be taken three to six feet in front of any building face. Submit the recorded information to the Architect noting any problems and the alternatives for mitigating actions.

PART 2 - PRODUCTS

2.01 NOT USED.

PART 3 - EXECUTION

3.01 NOT USED.

END OF SECTION

SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Products

B. Transportation and handling.

C. Storage and protection.

D. Product options.

E. Substitutions

1.02 PRODUCTS

A. Product: means new material, machinery, components, equipment, fixtures and systems forming Work. Does not include machinery and equipment used for preparation, fabrication, conveying and erection of Work. Products may also include existing materials or components required for reuse.

B. Do not use materials and equipment removed from existing premises, except as specifically permitted by Contract Documents.

C. Provide interchangeable components from the same manufacturer.

1.03 TRANSPORTATION AND HANDLING

A. Transport and handle products in accordance with manufacturer's instructions.

B. Promptly inspect shipments to assure that products comply with requirements, quantities are correct and products are undamaged.

C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement or damage.

1.04 STORAGE AND PROTECTION

A. Store and protect products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive products in weather-tight, climate controlled enclosures.

B. For exterior storage of fabricated products, place on sloped supports, above ground and protect as necessary to prevent deterioration or damage to the product.

C. When approved by the Owner, provide off-site storage and protection in a bonded warehouse approved by Owner when site does not permit on-site storage or protection at no cost to Owner.

D. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation.

E. Store loose granular materials on solid flat surfaces in well-drained area. Prevent mixing with foreign matter.

F. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement or damage.

G. Arrange storage of products to permit access for inspection. Periodically inspect to ensure products are undamaged and are maintained under specified conditions.

1.05 PRODUCT OPTIONS

A. Where products are specified by reference standards or by description only, provide products meeting those standards or that description, made by a manufacturer acceptable to Architect.

B. Where products are specified by naming one or more manufacturers, provide products of one of the named manufacturers that meets or exceeds specifications.

C. Where any specific article, device, equipment, product, material, fixture, patented process, form, method, or type of construction is indicated or specified by name, make, trade name, or catalog number, whether with or without the phrase "or equal," such specification shall be deemed to establish the minimum qualities of function, dimension, appearance, and performance (collectively the Basis of Design) for that material, process, or article. Such specification shall be deemed to be followed by the phrase "or equal."

D. If a named product, or named manufacturer’s equivalent product does not fully meet the specification, that manufacturer shall provide a custom or modified product to meet the specification.

E. Where expressly noted "no substitutions" in individual Sections, no product options are permitted.

F. When the phrase "or equal" is used or implied, it shall mean "an equivalent product, approved by the Architect in accordance with the requirements of this Section."

G. Products, proposed as substitutions, shall conform to requirements listed in the respective Section of this Manual and have at least 10 successful installations in commercial projects similar in scale and complexity to those required for this Project that have been in service for minimum of 5 years and remain in satisfactory condition.

1.06 SUBSTITUTIONS

A. Manufacturers and products listed in Specifications form basis for design and quality intended. Bidders may propose substitutions of equal design and quality and must be accompanied by completed Request Form included at end of this Section, other forms not permitted. Submit separate form for each proposed substitution. .
   1. Substitution requests, if any, shall be submitted to Architect 10 calendar days prior to Bid Opening Date. Architect will issue Addenda if accepted.

B. Substitutions must clearly be in Owner's best interest because of quality, cost, performance, conformity to code requirements or availability. Architect will make decision as to acceptance of proposed substitution.
   1. Submittal of proposed substitutions shall be made only by Prime Contractor(s). Architect will not review direct submittal by manufacturers, suppliers or subcontractors.
   2. Burden of proof as to equality of any material, process or article shall rest with Contractor. Provision authorizing submissions of "or equal" justification data shall not in any way authorize an extension of time for performance of this Contract.
   3. Substitutions shall, without exception, be manufactured of same basic materials and comply with or exceed all Specification requirements of dimension, function, structure and appearance, without deviation. Provide itemized comparison of quality and performance.
   4. Use of approved substitutions shall in no way relieve Contractor from responsibility for compliance with Contract Documents after installation. Contractor shall assume all extra costs caused by use of approved substitute materials.
   5. Statement indicating why specified material or product cannot be provided.
   6. Coordination information, including list of changes or modifications needed to other parts of Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
   7. Detailed side by side comparison of significant qualities of proposed substitution with those of the Work specified. Mark clearly affected specification Section for any differences from item specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect and specific features and requirements indicated.
   8. Product Data Samples, including drawings and descriptions of products and fabrication and installation procedures.
   9. List of similar installations for completed projects with project names and addresses and names and addresses of Architects and Owners.
   10. Material test reports from qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
   11. Cost information, including a proposal of change, if any, in the Contract Sum.
   12. Substitutions for specified product, brand or manufacture that have been submitted and disapproved by Architect shall not be resubmitted in any modified form.
   13. In case materials are substituted and installed without proper authorization, Contractor shall remove such materials and install those specified at his own expense.

14. Contractor shall determine effect approved substitutions will have on other portions of Work and so inform his subcontractors and employees of these effects.
15. Acceptance of proposed substitution shall be determined solely by specifying Architect. The final decision shall be the Architect's in accordance with the General Conditions.

C. Substitutions may be considered when product becomes unavailable through no fault of Contractor. Provide letter from manufacturer, on manufacturer's letterhead, stating lack of availability.

D. Unacceptable Substitutions: substitution requests initiated by late submittals that have caused materials to become unavailable due to delay in ordering and procurement will not be acceptable reason for substitutions.

E. Provide same warranty for substitution as for specified product.

F. Contractor shall pay costs for time required by Architect for review and for any redesign services associated with substitutions and for costs of re-approval by Regulatory Agencies.

G. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request.

H. Each subcontractor is responsible for providing products and construction methods compatible with products and construction methods of other subcontractors. If dispute arises between subcontractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

I. Substitution Submittal Procedure: In accordance with Division 01, General Requirements for Administrative Requirements and this Section.

J. All Substitutions for any material, system or product that would otherwise be regulated by DSA shall be included in an Addendum or Form DSA-140, and shall be approved by DSA prior to fabrication or use. (CAC Section 4-338(c) and IR A-6)

1.07 OWNER-FURNISHED, OWNER-INSTALLED WORK (OFOI)

A. Indicate in construction progress schedule owner-furnish owner-installed items and schedule time for installation.

B. Items indicated on Drawings as OFOI will be furnished by Owner and installed by Owner. Work indicated as OFOI will be performed under separate contract employees by Owner at its discretion. Where work of this Contract adjoins or conflicts with OFOI, work, Contractor shall cooperate with Owner and its employees in manner that will provide for reasonable and accurate completion of this Contract and work under separate contact.

C. Coordinate with OFOI work affecting this contract. Including verification and interfacing of this contract with OFOI work.

D. OWNER-FURNISHED, CONTRACTOR-INSTALLED WORK (OFCI)

E. Indicate in the construction progress Schedule Owner-Furnish Contractor-Installed items and schedule time for their installation.

F. Contractor shall verify exact sizes and services required for each item of equipment indicated on Drawings or in Project Manual as OFCI and shall obtain from Owner rough-in drawings, diagrams, setting templates and other necessary information to ensure proper mating of assemblies.

G. Contractor shall receive at project site each item of equipment from Owner and from that time on shall assume full responsibility for items and equipment until Substantial Completion.

H. Contractor shall give Owner 15 days prior notice of requirements for delivery to site of all OFCI equipment.

I. Contractor shall be responsible for receiving OFCI items and equipment and shall uncrate, inspect and notify Owner in writing within 7 days of receiving said items or equipment of acceptance or rejection of items or equipment. Owner, after receiving notice, will take appropriate action to have items or equipment made acceptable for Contractor's use. Rejected items shall be carefully stored and protected from damage by Contractor until Owner takes appropriate action.

J. Contractor shall be responsible for final placing, installation, connection, start-up, checking, testing and demonstrated satisfactory operation. Owner will provide names of manufacturer's representatives, who shall assist the Contractor in checking, testing and demonstrating equipment.

PART 2 - PRODUCTS

2.01 NOT USED

PART 3 - EXECUTION

3.01 NOT USED

END OF SECTION

HMC Architects

SUBSTITUTION REQUEST FORM

Project: _____ Substitution Request Number: _____

To: HMC Architects, Inc. From: _____

Re: _____ Date: _____

Architect's Project Number: _____ Contract For: _____

Specification Title: _____ Description: _____

Section: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____

Manufacturer: _____ Address: _____

Trade Name: _____

Attached data shall include: product description, specifications, drawings, photographs, and performance and test data adequate for evaluation of the request; applicable portions of the date are clearly identified.
Attached data also includes a description of changes to the Contract Documents that the proposed substitutions will require for its proper installation, at no cost to the Owner.
The Undersigned Certifies:

- Proposed substitution has been fully investigated and determined shall be equal or superior in respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing and construction costs caused by the substitutions.
- Reason(s) why substitution is being submitted.
  - ☐ Specified product or material is not available. Explain in detail as attachment.
  - ☐ Cost savings to Owner. Indicate comparative cost analysis as attachment.
  - ☐ Other. Explain:

Submitted by _____

Signed by: _____

Firm: _____

Address: _____

_____

Telephone: _____

A/E's REVIEW AND ACTION

☐ Substitution Approved

☐ Substitution Rejected as marked below:

- ☐ Insufficient information submitted
- ☐ Submitted late.
- ☐ Information not clearly marked.
- ☐ Full line product information (Binder not provided).
- ☐ Does not meet performance / design requirements of Paragraph _____
- ☐ Comparisons not properly identified on product data sheets.

Signed by: _____ Date: _____

Substantiating Data Required:

☐ Drawings	☐ Tests if required in individual sections
☒ Product Data	☐ Reports if required in individual sections
☒ Samples	☐ Other: _____

SECTION 01 70 00

EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Field engineering and surveying.

B. Requirements and limitations for cutting and patching of Work.

C. Cleaning throughout construction period.

D. Project Record Documents.

E. Closeout procedures.

F. Adjusting

G. Operation and maintenance data.

H. Warranty and Guarantee.

I. Spare parts and maintenance materials.

J. Instruction to Owner’s personnel.

1.02 FIELD ENGINEERING QUALITY CONTROL

A. Employ Land Surveyor registered in the State of California and acceptable to Architect.

B. Submit name, address and telephone number of Surveyor before starting survey work.

C. Maintain complete and accurate log of control and survey Work as it progresses.

D. On completion of foundation walls, floor slabs and major site improvements, prepare a certified survey illustrating dimensions, locations, angles and elevations of construction.

1.03 SURVEY REFERENCE POINTS

A. Contractor to locate and protect survey control and reference points.

B. Control datum for survey is that established by Owner provided survey.

C. Protect survey control points prior to starting site Work; preserve permanent reference points during construction.

D. Promptly report to the Architect loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to the Architect.

1.04 SURVEY REQUIREMENTS

A. Provide field engineering services. Use recognized engineering survey practices.

B. Establish a minimum of two permanent 3-inch diameter brass plate benchmarks on site, referenced to established control points. Record locations, with horizontal and vertical data on Project Record Documents. Establish additional temporary bench marks at all floor levels.

C. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means, make use of laser instrumentation. Contractor shall arrange and pay for Field Engineering and Staking.
1. Site improvements including pavements; stakes for grading, fill placement; utility locations, slopes, invert elevations and batter boards.
2. Grid or axis for structures.
3. Building foundation, column locations, ground floor elevations.
4. Floor elevations of existing structures that relate to project.
5. Partition layouts on rough floor as a guide to all trades.

D. Periodically verify layouts by same means.

1.05 layout markings

A. Layout markings shall not be made with xylene-based inks, paint, or dyes, or with other solvent-based products that may bleed through finishes.

1.06 EXISTING CONDITIONS

A. Before beginning Work, investigate and verify existence and location of mechanical, drainage, and electrical systems and other construction affecting Work, including underground utilities.
1. Before construction, survey and record points of connection of utility services.
2. Locate invert elevation at points of connection to existing sanitary- and storm drain, water-service piping, and underground electrical services.
3. Employ a utility service locator company to locate underground utilities.
4. Verify Owner’s Record Drawings.
5. Furnish survey of existing utilities.

1.07 CUTTING AND PATCHING

A. Where Work requires that particular existing building element such as partition, wall, paving, window, or similar element of existing building construction be removed, it is the intention of this Specification that such Work be part of the Demolition Section and not part of Cutting and Patching.

B. New Work required to replace such removals is considered as part of separate sections of Specifications covering similar new construction.

C. Where incidental cutting and patching is required for installation of a specific item or piece of equipment (including piping, ductwork, conduit, etc.), such cutting and patching is considered to be specified as part of that Section.

D. Contractor shall verify and check areas to be cut and patched and shall coordinate Work of various trades involved.

E. Where doubt exists as to size, location, or method of cutting concrete or any other structural element, including metal stud framing, Contractor shall contact Architect before proceeding.

F. Where doubt exists, Contractor shall distinguish between “cutting” and “demolition”.

G. Unless specifically indicated otherwise, existing Work cut, altered, or revised to accommodate new Work shall be patched to duplicate undisturbed adjacent finishes, colors, textures, and profiles. New Work in existing portions shall also be finished to match adjacent existing Work unless noted otherwise.

H. Submit written request in advance of cutting or alteration which affects any of the following.
   1. Structural integrity of any element of Project
   2. Integrity of weather-exposed or moisture-resistant element
   3. Efficiency, maintenance or safety of any operational element
   4. Visual qualities of sight exposed elements
   5. Work of Owner or separate Contractor
   6. Coordinated Drawings in accordance with Division 01, General Requirements (Section 01 30 00).

I. Include in request:
   1. Identification of Project.
   2. Location and description of affected Work.
   3. Necessity for cutting or alteration.
   4. Description of proposed Work and products to be used.
   5. Alternatives to cutting and patching.
   6. Effect on Work of Owner or separate Contractor.
   7. Written permission of affected separate Contractor.
   8. Date and time Work will be executed.

1.08 QUALITY ASSURANCE - CLEANING

A. Inspection: Conduct daily inspection, and more often if necessary, to verify that requirements of cleanliness are being met.

B. Codes and Standards: In addition to requirements specified herein, comply with pertinent requirements of authorities having jurisdiction.

C. For final cleaning, use only professional cleaning company experienced in commercial cleaning.

1.09 PAYMENT WITHHELD - CLEANING

A. Architect reserves right to withhold certification of payment requests for failure on part of Contractor to regularly clean Project in conformance with Requirements of this Section.

1.10 CLOSEOUT PROCEDURES

A. Owner Occupancy:
   1. Conform to Part 1, Title 24, Section 4-336 CCR Requirements for Verified Reports and Closeout Procedures.
   2. In conjunction with Project Inspector, Contractor shall prepare list of items (Punchlist) to be completed or corrected. List may be developed by areas when approved by Architect.
   3. Within time specified in the Certificate for Substantial completion after receipt of list, Architect will inspect to determine status of completion.
   4. Should Architect determine that Work is not complete:
      a. Architect will promptly notify Contractor in writing, giving reasons for his determination.
      b. Contractor shall remedy deficiencies and notify Architect when Work is ready for re-inspection.
      c. Architect will re-inspect Work.
   5. When Architect concurs that Work is substantially complete and ready for occupancy.
      a. Owner will prepare the Notice of Completion accompanied by Contractor's list (Punchlist) of items to be completed or corrected as verified by Architect.
      b. The Certified Notice of Completion will be submitted to the Owner and to Contractor for their written acceptance of responsibilities assigned to them in such notice.
      c. Contractor shall provide consent by insurer for Partial or Beneficial Occupancy.

B. Final Completion:
   1. Prepare and submit notice that Work is ready for final inspection and acceptance.
   2. Verify Work is complete.
   3. Clarify that:
      a. Work has been inspected by all governing agencies and is in compliance with Contract Documents.
      b. Work has been completed in accordance with Contract Documents.
      c. Equipment and systems have been tested as required and are operational.
      d. Work is completed and ready for final inspection.
   4. Architect will make an inspection to verify status of completion.
   5. Should Architect determine Work is incomplete or defective:
      a. Architect will promptly notify Contractor in writing, listing incomplete or defective Work.
      b. Contractor shall remedy deficiencies promptly and notify Architect when ready for re-inspection.
   6. When Architect determines Work is acceptable under the Contract Documents, he will request Contractor to make closeout submittals.

C. Closeout Submittals include, but are not necessarily limited to:
   1. Project Record Documents.
   2. Operation and maintenance data for items so listed in pertinent Sections of these Specifications and for other items when so approved by Architect.
   3. Warranties and Guarantees.
   4. Keys and keying schedule.
   5. Spare parts, materials, extra stock to be turned over to Owner.
   6. Evidence of payment and release of Stop Notices , when requested by Owner.
   7. List of subcontractors, service organizations and principal vendors, including names, addresses and telephone numbers, where they may be contacted for emergency service at all times, including nights, weekends and holidays.
   8. As condition precedent to Final Payment, submit documentation identifying amounts paid to Disabled Veteran Business Enterprises DVBE.

D. Final Payment:
   1. Submit Final Payment Request, showing all adjustments to Contract Sum.
   2. Retention will be released no sooner than 35 days after Notice of Completion has been recorded with County Recorders Office.

1.11 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

1.12 PROJECT RECORD DOCUMENTS

A. Record Documents: As-Built Drawings, Project Manual with Specifications including but not limited to the documents required herein.

B. Owner will provide one set of drawings and one copy of Project Manual for use during construction to record changes made during construction.

C. Record Documents: As-Built drawings and Project Manual, record in concise manner using industry-standard drafting techniques on drawings, on weekly basis all actual revisions to Work
   1. Changes made on Drawings, including Clarification Drawings.
   2. Changes made to Specifications.
   3. Changes made by Addenda.
   4. Changes made by Construction Change Directives/Instruction Bulletins, Architect's Supplemental Instructions, minor changes.
   5. Change Orders or other authorized Modifications to Contract.
   6. Revisions made to shop drawings, product data and samples.

D. Store Record Documents separate from documents used for construction. Replace soiled or illegible documents.

E. Record information concurrent with construction progress.

F. Specifications: Legibly mark and record at each product Section description of actual products installed, including following:
   1. Manufacturer's name, trade name, product model and number and supplier.

2. Authorized product substitutions or alternates utilized.
3. Changes made by Addenda and Modifications.

G. Record Documents and Shop Drawings: Legibly mark each item to record actual construction including:
1. Measured depths of foundations in relation to finish first floor datum.
2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements. Identify drains and sewers by invert elevation.
3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of Work. Identify ducts, dampers, valves, access doors and control equipment wiring.
4. Field changes of dimension and detail.
5. Details not on original drawings.

H. Obtain Architect's signed certification that Record Documents have been fully updated prior to submitting monthly payment requests. Compliance is mandatory before payment will be made.

I. Submit Record Documents certified by Inspector to Architect with claim for final Application for Payment. Fully completed Record Documents are a prerequisite to final payment.

1.13 OPERATION AND MAINTENANCE DATA

A. Submit six (6) sets prior to final inspection, bound in 8-1/2 by 11 inch text pages, in binders with durable covers. Include operation and maintenance data for all items for which submittals are requested in individual Sections of Specifications.

1.14 WARRANTY AND GUARANTEE

A. Contractor, manufacturer's warranties and guarantees not withstanding, warrants entire Work against defects in materials and workmanship for twelve (12) months from date of Certified Notice of Completion . Warranties and guarantees between Contractor and manufacturers and Contractor and suppliers shall not affect warranties or guarantees between Contractor and Owner. Refer to General and Supplementary Conditions for additional requirements.

B. Execute and assemble documents from subcontractors, suppliers and manufacturers.

C. Submit prior to final Application for Payment.

D. For items of Work delayed beyond date of Notice of Completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of Guarantee Period.

1.15 WARRANTIES - FORM OF SUBMITTALS

A. Bind in commercial quality, 8-1/2 by 11 inch, three-ring side binders with hardback, cleanable, plastic covers.

B. Label cover of each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible principal.

C. Table of Contents: Neatly typed, in sequence of Table of Contents of Project Manual, with each item identified with number and title of Specification Section in which specified, and name of product or Work item.

D. Separate each warranty or bond with index tab sheets keyed to Table of Contents listing. Provide full information, using separate typed sheets as necessary. List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

1.16 WARRANTIES - PREPARATION OF SUBMITTALS

A. Obtain warranties and bonds, executed in duplicate by responsible subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item or Work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until date of Certified Notice of Completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

1.17 WARRANTIES - TIME OF SUBMITTALS

A. For equipment or component parts of equipment put into service during construction with Owner's permission submit documents within ten days after acceptance.

B. Make other submittals within ten days after date of Certified Notice of Completion , prior to final Application for Payment.

C. For items of Work when acceptance is delayed beyond date of Notice of Completion, submit within ten days after acceptance, listing date of acceptance as beginning of warranty period.

1.18 SPARE PARTS AND MAINTENANCE MATERIALS

A. Provide products, spare parts, maintenance and extra materials in quantities specified in individual Specification Sections.

B. Deliver to project site location as directed by Owner.

1.19 INSTRUCTIONS TO OWNER'S PERSONNEL

A. Instruct Owner's personnel in proper operation and maintenance of all systems, equipment and similar items which were provided as part of Work. Provide maintenance and inspection schedules that conform to manufacturer's recommendations.

B. Contractor shall provide schedule to Owner for approval for each of instruction periods required.
   1. Organize instruction sessions into group sizes and schedule elapsed time for instruction in manner to provide complete coverage of subject matter.

C. Instruction sessions will be held in Owner designated area on project site and at Owner's convenience.

D. Prepare and submit to Architect a sign-in sheet with subject, date and time, signed by all participants for each session.

E. Instructors shall be qualified by product manufacturer in subject matter presented at each session.

PART 2 - PRODUCTS

2.01 MATERIALS - CUTTING AND PATCHING

A. Primary Products: Those required for original installation.

2.02 PRODUCTS FOR PATCHING AND EXTENDING WORK

A. New Materials: As specified in product sections; match existing products and Work for patching and extending Work.

B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing Work as standard.

2.03 CLEANING MATERIALS AND EQUIPMENT

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

2.04 COMPATIBILITY

A. Use cleaning materials and equipment that are compatible with surfaces being cleaned, as recommended by manufacturer of material to be cleaned.

PART 3 - EXECUTION

3.01 EXAMINATION - CUTTING AND PATCHING

A. Inspect existing conditions prior to commencing Work, including elements subject to damage or movement during cutting and patching. Confirm status and current warranties and guarantees.

B. After uncovering existing Work, inspect conditions affecting performance of Work.

1. Prior to cutting, boring or drilling through new or existing structural members or elements including reinforcing bars not specifically detailed, Contractor shall prepare detailed drawings for review and approval by Architect, Structural Engineer of Record and DSA Field Engineer. Approval by DSA is required prior to commencement of Work. Agency approvals will be obtained by Architect not Contractor.

C. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION - CUTTING AND PATCHING

A. Provide temporary support to ensure structural integrity of Work. Provide devices and methods to protect other portions of Project from damage.

B. Provide protection from elements for areas that may be exposed by uncovering Work.

C. Maintain excavations free of water.

3.03 CUTTING AND PATCHING

A. Execute cutting, fitting, and patching to complete Work.

B. Fit products together, to integrate with other Work.

C. Uncover Work to install ill-timed Work.

D. Remove and replace defective non-conforming Work.

E. Provide openings in Work for penetration of mechanical and electrical Work.

3.04 PERFORMANCE - CUTTING AND PATCHING

A. Execute Work by methods to avoid damage to other Work and which will provide appropriate surfaces to receive patching and finish.

B. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval. Torches or other flame cutting equipment shall not be used to cut metal studs without prior approval of the Architect.

C. Restore Work with new products in accordance with requirements of Contract Documents.

D. Fit Work air tight to pipes, sleeves, ducts, conduits and other penetrations through surfaces.

E. At penetrations of fire-rated walls, partitions, ceiling or floor construction, completely seal voids with UL-approved fire-rated devices to full thickness of penetrated element.

F. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

G. Extend patching to point where patching is not evident unless directed otherwise by Architect.

3.05 SLEEVES AND HANGERS

A. Provide conduit, outlets, piping sleeves, boxes, inserts or other materials or equipment necessary to be built into Work. Promptly furnish same and set such sleeves or other materials as construction program required.

B. In event delays occur in delivery of sleeves or other materials, arrange to have boxes or other forms set at locations where piping or other material is to pass through or into slabs or other Work.

C. Upon subsequent installation of sleeves or other material, install fill materials as required. Necessary expenditures incurred for boxing out or filling shall be without extra cost to Owner.

3.06 PROGRESS CLEANING

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

B. Site:
1. Daily, and more often if necessary, inspect site and pick up all scrap, debris, and waste material. Remove items to place designated for their storage. Combustible waste shall be removed from site. Flammable waste shall be kept in sealed metal containers until removed from site.
2. Weekly, and more often if necessary, inspect, arrangements of materials stored on site, re-stack, tidy, or otherwise service arrangements to meet requirements specified above.
3. Maintain site in neat and orderly condition.

C. Structures:
1. Weekly, and more often if necessary, inspect structures and pick up scrap, debris, and waste material. Remove items to place designated for their storage.
2. Weekly, and more often if necessary, sweep interior spaces clean.
   a. "Clean", for purpose of this subparagraph, shall be interpreted as meaning free from dust and other material capable of being removed by use of reasonable effort and handheld broom, i.e., "broom-clean".
3. As required preparatory to installation of succeeding materials, clean structures of pertinent portions thereof to degree of cleanliness recommended by manufacturer of succeeding material, using equipment and materials required to achieve required cleanliness.

4. Clean substrate; remove dirt, oil, grease, construction markings, and foreign matter that could adversely affect surface finish appearance or performance.
5. Following installation of finish floor materials, clean finish floor daily, and more often if necessary, and while Work is being performed in space in which finish materials have been installed.
    a. "Clean", for purpose of this subparagraph, shall be interpreted as meaning free from foreign materials which, in opinion of Architect, may be injurious to finish floor material, i.e., "vacuum clean".

3.07 FINAL CLEANING

A. Definition: Except as otherwise specifically provided, "clean", for purpose of Article, shall be interpreted as meaning level of cleanliness generally provided by skilled cleaners using commercial quality building maintenance equipment and materials, i.e., "scrub and polish clean".

B. General: Complete following cleaning operations before requesting inspection for certification of Notice of Completion.
1. Prior to completion of Work, remove from jobsite all tools, surplus materials, equipment, scrap, debris, and waste, conduct final progress cleaning as described above.
2. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
    a. Unless otherwise specifically directed by Architect, water and broom clean paved areas on site and public paved areas directly adjacent to site. Remove resultant debris.
3. Rake grounds that are neither planted nor paved to smooth, even-textured surface.
4. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.

C. Structures:
1. Exterior: In areas affected by Work under this Contract, visually inspect exterior surfaces and remove traces of soils, waste material, smudges and other foreign matter. Remove traces of splashed material from adjacent surfaces. If necessary to achieve uniform degree of exterior cleanliness, hose down exterior of structure. In event of stubborn stains not removable with water, Architect may require light sandblasting or other cleaning at no additional cost to Owner.
2. Interior: In areas affected by Work under this Contract, visually inspect interior surfaces and remove traces of soil waste material, smudges, and other foreign matter. Remove traces of splashed materials from adjacent surfaces. Remove paint drippings, spots, stains, and dirt from finished surfaces. Use only cleaning materials and equipment instructed by manufacturer of surface material.
3. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.

4. Polished Surfaces: On surfaces requiring routine application of buffed polish, apply polish recommended by manufacturer of material being polished. Glossy surfaces shall be cleaned and shined as intended by manufacturer.
5. Carpet: Use only dry-chemical method of cleaning. Steam cleaning or water based cleaning shall not be used on carpet. Use only dry-chemical materials and methods fully approved by carpet manufacturer, as instructed in manufacturer's published literature.
6. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
    a. Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.

D. Mechanical and Electrical Systems
1. Wipe surfaces of mechanical and electrical equipment, [elevator equipment,] and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
2. Replace parts subject to unusual operating conditions.
3. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
4. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
5. Clean ducts, blowers, and coils if units were operated without filters during construction.
6. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

E. Timing: Schedule final cleaning acceptable to the Architect to enable Owner to accept completely clean project.

3.08 CLEANING DURING OWNER'S OCCUPANCY

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

END OF SECTION

SECTION 01 74 19

CONSTRUCTION WASTE MANAGEMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Preparation and implementation, including reporting and documentation, of a Waste Management Plan for reusing, recycling, salvage or disposal of non-hazardous waste materials generated during demolition and/or new construction (Construction & Demolition (C&D) Waste), to foster material recovery and re-use and to minimize disposal in land fills.

B. Related Sections
   1. Section 01 30 00 Administrative Requirements.
   2. Section 01 35 42 CalGreen Requirements.

1.02 REFERENCES

A. California Integrated Waste management Act of 1989 (AB 939)

B. California Code of Regulations Title 14, Section 18700

C. California Green Building Standards Code, CalGreen, Title 24, Part 11.

1.03 ACTION SUBMITTALS

A. Waste Management Plan (Appendix A): Within 10 calendar days after the Notice to Proceed and prior to any waste removal, submit the following to the Architect for review and approval. Update quarterly. Include:
   1. Materials to be recycled, reused, or salvaged, either onsite or offsite.
   2. Estimates of construction waste quantity (in tons) by type of material. (If waste is measured by volume, give factors for conversion to weight in tons.)
   3. Procedures for recycling/ reuse program.
   4. Permit or license and location of Project waste-disposal areas.
   5. Site plan for placement of waste containers.

B. Waste Management Monthly Progress Report (Appendix B): Summary of waste generated by Project, monthly with Application for Payment. Include:
   1. Firms accepting the recovered or waste materials.
   2. Type and location of accepting facilities (landfill, recovery facility, used materials yard, etc.). If materials are reused or recycled on the Project site, location should be designated as “on-site reuse / recycling”.
   3. Type of materials and net weight (tons) of each.
   4. Value of the materials or disposal fee paid.
   5. Attach weigh bills and other documentation confirming amount and disposal location of waste materials.

1.04 Waste Management Final Compliance Report: Final update of Waste Management

Plan to provide summary of total waste generated by Project.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION

A. Collection and separation of all construction waste materials generated on-site, reuse or recycling on-site, transportation to approved recyclers or reuse organizations, or transportation to legally designated landfills, for the purpose of recycling salvaging and/or reusing a minimum of 50% of the construction waste generated.

PART 3 - EXECUTION

3.01 IMPLEMENTATION

A. Implement approved Waste Management Plan including collecting, segregating, storing, transporting and documenting each type of waste material generated, recycled or reused, or disposed in landfills.

B. Designate an on-site person to be responsible for instructing workers and overseeing the sorting and recording of waste/recyclable materials.

C. Include waste management and recycling in worker orientation and as an agenda item for regular Project meetings.

D. Recyclable and waste bin areas shall be limited to areas approved on the Waste Management Plan. Keep recycling and waste bins neat and clearly marked to avoid contamination of materials.

3.02 ATTACHMENTS

A. Appendix A: Waste Management Plan

B. Appendix B: Waste Management Monthly Progress Report

END OF SECTION

SECTION 01 74 19 - APPENDIX A

WASTE MANAGEMENT PLAN

Date: _____

Within 10 calendar days after the Notice to Proceed and prior to any waste removal, the Construction Manager shall submit the following to the Architect for review and approval. Update quarterly.

PROJECT _____

OWNER _____

CONTRACTOR _____

Address _____

Telephone, Fax, eMail _____

Material Type (1)	Estimated Tons Recycled (2)	Estimated Tons Reused (3)	Estimated Tons Salvaged (4)	Estimated Tons Landfilled (5)	Proposed Disposal or Recycling Facility (6)
Total					
Diversion Rate: Columns [(2)+(3)+(4)] / [(2)+(3)+(4)+(5)]					

(1) Provide type of material targeted for recycling, reuse, and/or salvage, either on or off site, and include a category for general waste materials requiring landfill disposal.

(2) through (4) Provide estimated quantities (in tons) of recyclable, reusable, or salvageable waste materials anticipated shall be generated.

(5) Provide estimated quantities (in tons) of material shall be disposed in landfill.

(6) Provide destination of recycled, salvaged, and disposed materials (i.e. onsite, recycling facility, etc.)

General: Attach proposed Recycling & Waste Bin Location Plan.

Attach name and contact data for each recycling or disposal destination shall be used.

SECTION 01 74 19 - APPENDIX B

WASTE MANAGEMENT - MONTHLY PROGRESS REPORT

Starting Date _____ Ending Date _____

PROJECT _____

OWNER _____

CONTRACTOR _____

Address _____

Telephone, Fax, eMail _____

Submit this Report monthly with each Application for Payment.

Material Type (1)	Actual Tons Recycled (2)	Actual Tons Reused (3)	Actual Tons Salvaged (4)	Actual Tons Landfilled (5)	Disposal or Recycling Facility (6)
Total					
Diversion Rate: Columns [(2)+(3)+(4)] / [(2)+(3)+(4)+(5)]					

(1) Provide type of materials recycled, reused, and/or salvaged, either on or off site, and include a category for general waste materials disposed in a landfill.

(2) through (4) Provide quantities (in tons) of recyclable, reusable, or salvageable waste materials generated.

(5) Provide quantities (in tons) of material disposed in landfill.

(6) Provide destination of recycled, salvaged, and disposed materials (i.e. onsite, recycling facility, etc.)

General: Attach name and contact data for each recycling or disposal destination used.

SECTION 01 80 00

FACILITY OPERATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Starting systems.

B. Demonstration and instructions.

C. Testing, adjusting and balancing.

1.02 STARTING SYSTEMS

A. Coordinate schedule for start-up of various equipment and systems.

B. Notify Architect and Owner 7 days prior to start-up of each item.

C. Verify that each piece of equipment or system has been checked for proper control sequence or other conditions that may cause damage.

D. Verify that tests, meter readings, and specified electrical characteristics agree with those required by equipment or system manufacturer.

E. Verify wiring and support components for each equipment are complete and tested.

F. Execute start-up under supervision of responsible manufacturer's representative or approved Contractors' personnel in accordance with manufacturers' instructions.

G. When specified in individual Specification Sections, require manufacturer to provide authorized representative to be present as site to inspect, check and approved equipment or system installation prior to start-up and to supervise placing equipment or system in operation.

H. Submit written report that equipment or system has been properly installed and is functioning correctly.

1.03 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of Product to Owner's personnel two weeks prior to date of Notice of Completion.

B. Demonstrate Project equipment and provide instruction by qualified manufacturer's representative who is knowledgeable about Project.

C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

D. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owners' personnel in detail to explain all aspects of operation and maintenance.

E. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance and shutdown of each item of equipment at agreed-upon times at equipment location.

F. Prepare and submit to Architect a sign-in sheet with subject, date and time, signed by all participants for each session.

G. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

H. Amount of time required for instruction on each item of equipment and system is that specified in individual Sections.

1.04 TESTING, ADJUSTING AND BALANCING OF EQUIPMENT

A. Refer to Division 23 Heating, Ventilating, and Air Conditioning.

PART 2 - PRODUCTS

2.01 NOT USED.

PART 3 - EXECUTION

3.01 NOT USED.

END OF SECTION

SECTION 01 81 19

CONSTRUCTION INDOOR AIR QUALITY

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes
   1. Temporary construction ventilation, dust protection, preconditioning of materials, protection of materials, sequencing, duct protection, and duct cleaning to insure good indoor air quality after occupancy to be performed by the CONTRACTOR.

B. Related Sections
   1. Section 01 30 00, Administrative Requirements
   2. Section 01 60 00, Product Requirements

1.02 REFERENCES

A. SMACNA - IAQ Guidelines for Occupied Buildings Under Construction, 1995, Chapter 3.

B. ASHRAE Standard 52.2-1999 – Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size (ANSI approved)

1.03 CLASSIFICATION OF RELEVANT MATERIALS

A. VOC-Emitting Materials
   1. Section 06 10 00 Rough Carpentry
      a. Composite wood products containing added urea-formaldehyde
   2. Section 06 41 16 Casework
      a. Adhesives applied on-site
      b. Composite wood products containing added urea-formaldehyde
   3. Section 07 21 00 Insulation
      a. Batt insulation, unless formaldehyde-free
      b. Adhesives applied on-site
   4. Section 07 92 00 Joint Sealers
      a. All joint sealers applied on-site on the interior side of the building envelope.
   5. Section 09 65 19 Resilient Tile Flooring
      a. Adhesives
   6. Section 09 65 13 Resilient Base
      a. Adhesives
   7. Section 09 90 00 Painting

B. Porous and Fibrous Materials
   1. Section 09 51 00 Acoustical Ceilings - Lay-In

1.04 SUBMITTALS

A. Submit eighteen (18) photographs documenting compliance with this Section. Provide six (6) photographs each at three (3) different phases of construction.

B. Contractor shall develop and submit to the Architect for review the Construction Indoor Air Quality (IAQ) Plan as required in this Section. A template form is provided as Appendix A of this Specification. The plan shall be submitted along with the first submittal for any of the products listed above.

1.05 SUBSTITUTIONS

A. Construction Indoor Air Quality (IAQ) requirements described below are based upon practices described in SMACNA *IAQ Guidelines for Occupied Buildings Under Construction,* 1995. Any modifications to or substitutions of requirements described in this Section must comply with the abovementioned SMACNA guideline.

PART 2 - PRODUCTS

2.01 NOT USED.

PART 3 - EXECUTION

3.01 QUALITY ASSURANCE

A. Inspection: Contractor shall conduct inspections to confirm that construction IAQ measures proposed in the Construction IAQ Plan are being followed, and be prepared to report compliance with the Plan at progress meetings.

3.02 PROJECT CONDITIONS

A. Air Filtration:
   1. Systems designed with particle filters shall not be operated without filters in place. Temporary construction filters shall have a minimum MERV rating of 8.
   2. Replace all air filtration media immediately prior to occupancy. Post-construction air filters shall have a minimum MERV rating of 13.

B. Construction Ventilation: Following building enclosure, maintain continuous temporary ventilation of areas during installation of VOC-Emitting Materials identified in paragraph 1.04 of this Section. Construction Ventilation shall be provided for post-occupancy touch-up work involving VOC-Emitting materials. It is not required during Building Flush-Out.
   1. Ventilation shall be supplied via open windows and doors, temporary ducts, and temporary fans, sufficient to provide no less than three (3) air changes per hour.
   2. When continuous ventilation is not practical via temporary fans and exhaust to outside, then ventilation shall be supplied via the building's HVAC system and shall comply with the following requirements:
      a. Provide temporary air filters at return air grilles.
      b. Provide 100% outside air. Relative humidity not to exceed 60%.
      c. Provide a minimum of three (3) air changes per hour.

3. Maintain continuous ventilation for a minimum period of 72 hours after installation of VOC-Emitting Materials, unless otherwise indicated elsewhere in these Specifications.
4. Ventilate areas directly to outside; ventilation to other enclosed areas is not acceptable.

C. Preconditioning: Prior to installation, allow contractor-furnished contractor-installed VOC-Emitting Furnishings and Equipment as identified in paragraph 1.04 of this Section to off-gas in dry, well-ventilated space for 14 calendar days to allow for reasonable dissipation of odors and emissions.
1. Remove containers and packaging to maximize off-gassing of VOCs.
2. Precondition products in ventilated warehouse or other ventilated building. Preconditioning at the project site is acceptable, provided that Temporary Construction Ventilation and Sequencing measures are taken as described elsewhere in this Specification.
3. Products requiring preconditioning include, at minimum, contractor-furnished and contractor-installed VOC-Emitting Furnishings and Equipment that contain vinyl or other flexible plastics, resins, adhesives, foam rubber, and fiberboards with urea-formaldehyde binders. Products bearing Greenguard certification (www.greenguard.org) shall be excluded from the preconditioning requirement.

3.03 SEQUENCING

A. On-Site Application: Where VOC-Emitting Materials as identified in paragraph 1.03 of this Specification are applied on-site, apply prior to installation of Porous and Fibrous Materials as identified in paragraph 1.04 of this Specification. Maintain continuous ventilation for a period of 72 hours before installation of porous and fibrous materials.
1. Where this sequencing requirement is not possible, protect porous materials with polyethylene vapor retarders. Tape all polyethylene edges to insure a complete seal. Maintain continuous ventilation per temporary construction ventilation requirements described above for a period of 72 hours before removing polyethylene.

B. Completion: Complete interior finish material installation prior to Building Flush-Out as described in paragraph 3.06 of this Section.

3.04 PROTECTION

A. Moisture Protection: Protect interior materials from water intrusion or penetration as described in Section 01 60 00 Product Requirements.
1. Porous or fibrous materials with visible microbial growth shall not be installed.
2. Non-porous materials with visible microbial growth shall be decontaminated.

B. Duct Protection: during dust-producing activities (e.g. sanding, cutting, or grinding), or when VOC-Emitting Materials (as described in paragraph 1.04 above) are being installed, implement the following measures:
1. If possible, damper off the return (negative pressure) side of HVAC air distribution system and seal return system openings with polyethylene sheet.
2. If HVAC system must be operated during dust-producing activities, provide temporary construction air filters with a minimum MERV rating of 8 at all return air grilles.

3. If HVAC supply air is off, protect diffusers and openings with polyethylene sheet.

3.05 CLEANING

A. Provide the following cleaning in addition to requirements described in Section 01 70 00 Execution Requirements:
   1. Clean all coils, air filters, and fans prior to Testing and Balancing.
   2. If significant dust collection is observed at diffusers, return air grilles, or in ducts, clean prior to system start-up.

3.06 BUILDING FLUSH-OUT

A. Just prior to Substantial Completion, but following Testing and Balancing, flush out building using the building HVAC system, maintaining a minimum temperature of 60° F and maximum 60% relative humidity as follows:
   1. Provide continuous 24 hour ventilation with all air handling unit dampers at their maximum outdoor air position and all supply fans at their maximum position and maximum rate for at least 14 days.
   2. Following building occupancy, it touch up work involving products with chemical emissions is required, provide temporary construction ventilation during application and following flush out requirements above for a minimum of 4 days after touch up application.
   3. During occupancy, in the event that the schedule does not permit a 14 day flush-out prior to occupancy, the contractor must conduct the flush-out while the building is occupied. Prior to occupancy, the contractor must comply with all measures to protect building occupants outlined in CHPS, 2009 Credit EQ2.0A.P2.

B. Insure that MERV 13 air filters are in place during Building Flush-Out.

C. Installation of furniture and equipment may occur during Building Flush-Out.

D. Return ventilation system to normal operation following Building Flush-Out period to minimize energy consumption.

E. Immediately following Building Flush-Out, replace air filters with new MERV 13 air filters. Air filters that handle solely outside air need not be replaced.

END OF SECTION

APPENDIX A

CONSTRUCTION INDOOR AIR QUALITY (IAQ) PLAN

CONTRACTOR [CONSTRUCTION MANAGER]:

Name: _____ Title: _____

Telephone: _____ Fax: _____

Email: _____

I have read and understood and will implement the following Construction IAQ Plan:

Signature: _____ Date: _____

I. CONSTRUCTION VENTILATION

List all project materials requiring Construction Ventilation per Specification Section 01 81 19. Attach additional sheet if necessary.	
Y / N	Ventilation will be supplied via open windows, temporary ducts, and temporary fans. If "Y", then supply air diffusers, return air grilles, and/or open ducts will be sealed.
Y / N	Ventilation will be supplied via area exhaust fans. If "Y", check applicable: ☐ Supply air diffusers, return air grilles, and/or open ducts will be sealed. Make-up air will be provided through open windows or doors or other transfer air devices. ☐ HVAC system will provide make-up air. Return air grilles will be sealed.
Y / N	Ventilation will be supplied via building's HVAC system. If "Y", check applicable: ☐ Return air grilles are sealed. Exhaust is provided via open windows or doors. ☐ Return air grilles are used for exhaust. HVAC will provide 100% outside air. Air filters with a minimum MERV rating of 8 will be provided at return air grilles.
☐ Required	Areas will be ventilated directly to outside. No ventilated air will be returned.
☐ Required	Ventilation will provide no less than three air changes per hour.
☐ Required	Ventilation will be continuous for a period no less than 72 hours after completion of installation.
☐ Required	All filtration used during Construction Ventilation will be replaced prior to Substantial Completion.

II. PRECONDITIONING

List all project materials requiring Preconditioning per Specification Section 01 81 19. Attach additional sheet if necessary.

Y / N	Preconditioning will occur in dry and well-ventilated offsite location. If "Y": Where is the offsite location? _____
Y / N	Preconditioning will occur onsite. If "Y", check applicable: ☐ Ventilation will be supplied via open windows, temporary ducts, and temporary fans. See I.2a above. ☐ Ventilation will be supplied via area exhaust fans. See I.2b above. ☐ Ventilation will be supplied via building's HVAC system. See I.2c above.
☐ Required	Containers and packaging will be removed prior to Preconditioning.
☐ Required	Preconditioning will occur for fourteen (14) continuous days prior to installation.

III. SEQUENCING

List all project materials requiring Sequencing consideration per Specification Section 01 81 19. Attach additional sheet if necessary.

☐ Required	Previously installed Porous or Fibrous Materials located in a room where VOC-Emitting Materials are to be installed will be protected with polyethylene vapor retarder. Polyethylene will not be removed until completion of a 72-hour ventilation period.
☐ Required	Installation of interior finish materials will complete fourteen (14) days prior to Substantial Completion.

IV. PROTECTION

List all project materials requiring Protection per Specification Section 01 81 19. Attach additional sheet if necessary.	
☐ Required	Porous or Fibrous Materials with visible microbial growth shall not be installed.
☐ Required	Materials that are not defined as Porous or Fibrous with visible microbial growth shall be decontaminated prior to installation.
☐ Required	Temporary ventilation will be provided during all dust producing activities. See Item I Construction Ventilation above. All supply air diffusers and return air grilles will be covered.
☐ Required	Ducts will be sealed during transportation, delivery, and construction.

END OF APPENDIX A

SECTION 02 41 19

SELECTIVE DEMOLITION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Remove designated building equipment, fixtures, components and utilities to permit installation of new construction.

B. Include Work required to demolish and remove elements of existing construction including flooring, walls, doors, ceilings, concrete, and similar elements of existing building construction, all as noted on Drawings or as required to permit installation of new construction. Refer to Cutting and Patching in Section 01 70 00 for differentiation between "Demolition" and "Cutting and Patching".

C. Comply with Title 24, Part 9, California Fire Code, Chapter 33 Fire Safety During Construction and Demolition, during all Phases of project.

1.02 REFERENCE STANDARDS

A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.

B. CBC - 2016 California Building Code
   1. CBC-19A - CBC Chapter 19A, Concrete.
   2. CBC-33 - CBC Chapter 33, Safeguards During Construction

C. CCR - California Code of Regulations
   1. CCR-8.4 - Title 8, Subchapter 4, Construction Safety Orders

D. CFC - 2016 California Fire Code
   1. CFC-5 - CFC Chapter 5, Fire Service Features
   2. CFC-7, CFC Chapter 7, Fire-Resistance-Rated Construction
   3. CFC-9 - CFC Chapter 9, Fire Protection Systems
   4. CFC-33 - CFC Chapter 33, Fire Safety During Construction and Demolition

E. ICRI - International Concrete Repair Institute.

F. DSA IR 25-2.13 - Division of the State Architect Interpretation of Regulations

G. NFPA - National Fire Protection Association
   1. NFPA 241- Safeguarding Construction, Alteration and Demolition Operations

H. SCAQMD - South Coast Air Quality Management District
   1. SCAQMD-1403 - Rule 1403, Asbestos Emissions from Demolition / Renovation Activities

1.03 ADMINISTRATIVE REQUIREMENTS

A. Pre-Demolition Conference: Conduct conference at Project site to comply with below and requirements in Section 01 30 00.

B. Contractor shall schedule meeting after Notice of Award to review demolition operations.

C. Attendance Required: Owner, Architect, Contractor, Demolition Subcontractors, Project Inspector.

D. Construction Process:
1. Contractor shall discuss overview of demolition procedures.
2. Contractor shall identify items to be selected by Owner for salvage.
3. Contractor shall review special requirements for equipment, safety, and noise.

E. Architect will record minutes and distribute copies within seven days after meeting to participants and those affected by decisions made.

F. Regulatory Requirements: Secure demolition permit from the Local Air Quality Management District for renovations involving the removal of 100 square feet/linear feet or greater of demolition, per District Regulations [BAAQMD 11-2-401.3]. Notify the AQMD at least 10 working days prior to commencement of demolition/renovation.

1.04 SUBMITTALS

A. Project Record Documents accurately record actual locations of capped utilities.

B. Pre-demolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by demolition operations. Comply with Division 01. Submit before Work begins.

1.05 EXISTING CONDITIONS

A. Before beginning Work, investigate and verify existence and location of mechanical, drainage, and electrical systems and other construction affecting Work, including underground utilities.
1. Before construction, survey and record points of connection of utility services.
2. Locate invert elevation at points of connection to existing sanitary - and storm drain, water-service piping, and underground electrical services.
3. Employ a utility service locator company to locate underground utilities.
4. Verify Owner’¢s Record Drawings.
5. Furnish survey of existing utilities.

PART 2 - PRODUCTS

A. NOT USED.

PART 3 - EXECUTION

3.01 PREPARATION

A. Disconnect, remove and cap designated utility services within demolition areas. Notify Owner 48 hours in advance of any utility shut-down.

B. Prior to commencement of demolition operations, notify Underground Service Alert of Southern California (800) 422-4133, Monday through Friday, 7:00 A.M. to 5:00 P.M.

C. Protection:
   1. Protect existing items that are not indicated to be altered.
   2. Adequately protect staff and public from harm and accident during demolition operations by the erection of proper barricades, signs, lighting, guard rails or other safety precautions. Conform to Title 8, Subchapter 4, CCR and NFPA 241.
   3. Protective Devices: Install substantial enclosures, weatherproof and dust-proof shields, protective covers, screens and similar devices. Erect and move when necessary to permit use of existing rooms, areas or facilities. Remove entirely when their use is no longer essential. Patch or repair all areas where devices have been removed.

D. Survey of Existing Conditions: Record existing conditions by use of measured drawings and preconstruction photographs or video.
   1. Comply with requirements specified in Division 01.
   2. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.

3.02 TEMPORARY MEASURES - LIFE SAFETY

A. Emergency Exits: No enclosure, shield or protective covering shall interfere with use of emergency exits in existing facilities at any time. Rated egress systems shall provide temporary rated egress.

B. Maintain fully charged certified compliant fire extinguishers and water hoses readily available during demolition operations, per Section 906 CBC. Test electrical conductors for disconnection prior to removing.

C. Provide temporary, but equivalent, fire alarm, detection or suppression systems when any system is impaired by Work of this Section. Temporary systems shall be inspected and tested monthly or at other more frequent intervals as required by Owner.

D. Impairment of fire protection systems, Section 3308.6: Impairments to any fire protection system shall be in accordance with Section 901.
   1. Systems out of Service: Per requirement of Section 901.7 through 901.7.6, California Fire Code.

E. Maintain free and unobstructed access to emergency services per Title 19, CFC 503.1; 503.1.1, 503.4; and Appendix D, CFC Chapter 33 Sections 3310.1; 3312.1 and when required by Owner.

F. Post NO SMOKING signs in English and Spanish, in number and location as approved by Architect.

G. Reduce flammable and combustible fire load to minimum by daily removal of debris.

H. Instruct construction personnel in fire safety and fire drill policies appropriate for areas where demolition operations occur.

I. Deployment, disposition, administration and implementation of any and all safety measures shall be sole responsibility of Contractor.

3.03 EXECUTION

A. Demolish in orderly and careful manner. Maintain protected egress and access at all times.

B. Except where noted otherwise, immediately remove demolished materials from site and dispose legally. Do not utilize Owner's disposal system.

C. Remove materials to be re-installed or retained in manner to prevent damage. Store and protect until re-installation.

D. Do not burn or bury materials on site.

E. Upon completion of Work, leave areas of Work in clean condition.

3.04 SELECTIVE DEMOLITION, REPAIR AND ALTERATIONS WORK

A. New and existing Work that is cut into, altered, damaged, relocated or reinstalled shall be restored to original conditions. Workmanship and materials to conform to applicable provisions of other applicable Sections of Specifications.

B. Cutting Equipment: Jack-hammers and vibratory cutting equipment may be utilized under following conditions:
   1. Approval by Owner.
   2. Time of day and duration of Work on each given day shall be coordinated with Project Inspector and Owner. Minimum of 24 hours advance notice required.
   3. Compressors shall be well muffled.
   4. Every consideration shall be exercised toward comfort of staff and public. Excessive noise or vibrations will constitute just cause for immediate stoppage of Work.

C. Cutting:
   1. Conform to Provisions of Division 01, General Requirements.
   2. Concrete: Cut with saws or other approved method, but do not overcut openings. Reinforcing bars, except where bonded into new concrete, shall be cut off and ends painted with bituminous paint before being enclosed.
   3. Structural Members: Cut only when authorized by Architect and approved by Structural engineer of Record, and DGS/DSA. Agency approvals shall be obtained by Architect, not by Contractor.

4. Slab-on-grade concrete cutting: saw cut areas indicated, remove aggregate course and excavate subgrade for utility trenches required for depths, and for other non-utility areas as indicated.
    a. Bedding materials for utility trenches: sand consisting of natural or manufactured granular material conforming to Subsection 200-1.5.5, SSPWC, must achieve compaction of a minimum 90%.
    b. Backfill, stockpiled fill: Granular, free of debris, no gravel larger than 3 inches in any dimension, non-expansive, approved by the Architect prior to placement on the site. Install clean backfill and re-compact 6" lifts to 90% per ASTM D1557.
    c. Install reinforcing steel, match existing sizes and spacing, minimum #3 deformed bars spaced 18" oc. Dowel in place by drilling 12" inches into existing concrete and epoxy in place.
    d. Underslab Vapor Barrier: ASTM E 1745, Class A, 15 mils thick, Permeance as tested before and after mandatory conditioning (ASTM E 1745 Section 7.1 and sub-paragraphs 7.1.1 – 7.1.5): less than 0.01 grains/(ft²/hr/inHg).
    e. Install and finish Concrete, minimum 4000 psi compressive strength. Finish: to match existing surface.

D. Removal of Existing Floor Finishes:
1. Remove existing floor covering materials in areas indicated.
2. Sandblast concrete floor surfaces (or submit alternate method to Architect for approval) to remove remaining adhesive, mortar, paint and similar materials which will affect bond of new floor coverings. International Concrete Repair Institute, ICRI Concrete Surface Profile CSP #3 (light shot blast).
3. Patch voids with non-shrink grout.
4. Grind high spots and fill low spots to provide an even surfaced substrate for specified new floor covering materials. Leveling materials shall be compatible with mortars and adhesives required to install finish floors. Floors shall not vary more than 1/4 inch in 10 feet as determined with straightedge.

E. Patching, Repairing and Finishing:
1. Concrete: Edges of existing concrete shall be kept damp for 24 hours and scrubbed with Neat Portland Cement grout just before new concrete is placed. In lieu thereof, an approved epoxy concrete adhesive may be used. Finish shall match existing adjoining Work.
2. Unless otherwise approved concrete shall match strength of existing concrete or be minimum 3,000 psi concrete for patching slabs on grade. Strength of concrete for patching structural members or deck fill shall be determined by Architect. Where cut edges are to remain exposed, finish edges with cement mortar at least 3/4 inch thick, applied over epoxy adhesive and finished to match adjoining surfaces.
3. Concrete mix for patching shall comply with Section 1905A.3 California Building Code.
4. At Removed Flooring Materials: trowel with patching compound, cement based at all areas, leave level, smooth ready to receive new flooring finish materials. At contractor's option install cement-base self-leveling underlayment at no cost to the Owner.
5. At removed casework and equipment: repair and patch surfaces with like materials and to match adjacent surfaces. Leave surfaces in acceptable condition as determined by the Architect to received new finishes.

F. Acoustical Ceilings: Existing acoustical ceiling that will be partially removed or will require patching, shall be repaired (or extended) with materials and suspension system identical to existing materials and suspension system. In no case shall components added be less in standard as defined in DSA IR 25-2.13.

G. Doors: Remove units in manner to minimize damage to framing supports and finishes. Remove or cut associated anchorage to permit new installation. When walls are to remain in place disassemble units carefully to prevent damage to wall.

H. Painting: Areas to be repainted or patched shall be prepared and finished as specified in Section 09 90 00, Painting. Where painting of existing surfaces is scheduled, paint manufacturer's standard specification for interior or exterior maintenance painting may be utilized, when approved by Architect for each surface application.

I. Holes required through existing stud wall, concrete or masonry construction to accommodate new electrical conduits and piping and ductwork shall be provided as specified in Division 22, Plumbing; Division 23, Heating Ventilating and Air Conditioning; Division 26, Electrical and Division 27 Communications.

J. Holes required through concrete or masonry Work required for structural purposes shall be neatly drilled as required to accommodate specific items. Coring shall be performed with approval of Architect and in accordance with details on Drawings.
   1. Approval of details by DGS/DSA is required. Agency approvals shall be obtained by Architect, not by Contractor.

K. Work shall be fully coordinated to ensure proper sequence, limits, methods and time of performance. Arrange Work so as to impose a minimum of hardship on present operation of facilities.

L. Remove such existing ceilings, floors, walls, finish materials or equipment as required to complete Work. Restore such surfaces to their original condition after Work is completed.

M. Provide adequate ventilation during all operations to prevent accumulation of dust, fumes, vapors or gases.

N. Miscellaneous Removal Items: Items not specifically mentioned shall be removed as indicated on drawings.

O. Miscellaneous Work: Items not specifically mentioned shall be repaired, patched or finished like new Work or to match existing adjoining surfaces as approved. Surfaces damaged shall be restored to original condition.

3.05 SALVAGE AND DISPOSAL

A. Disposal: Removed material, other than items directed to be salvaged or indicated to be reused, become Contractor's property upon removal, and shall be removed from site. Debris shall be picked up and disposed of, off site, by Contractor promptly and continuously as Work progresses, and not allowed to accumulate. Sprinkle the debris to prevent dust nuisance. Secure and pay for required hauling permits and pay dumping fees and charges. Contractor shall make every reasonable effort to divert debris to recycling or reuse facilities.

END OF SECTION

SECTION 03 01 30

CONCRETE CLEANING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Chemical cleaning of existing concrete surfaces.

1.02 SUBMITTALS

A. Data on cleaning solutions.

B. Manufacturers' application instructions.

1.03 QUALITY ASSURANCE

A. Pre-installation Conference
   1. Convene pre-installation conference one week before starting Work of this Section.
   2. Require attendance of parties directly affecting Work of this Section.
   3. Review conditions and proposed procedures.

B. Mockups: Prepare mockups on existing surface under same weather conditions to be expected during remainder of the Work.
   a. Clean an area approximately 25 square feet for chemical cleaning. Chemical methods.

1.04 DELIVERY, STORAGE AND HANDLING

A. Furnish materials in manufacturer's packaging including instructions for use.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Do not wash down or wet surfaces when temperature may drop below 40 degrees F within twenty-four hours.

1.06 SEQUENCING/SCHEDULING

A. Perform cleaning of surfaces during hours approved by the Owner.

PART 2 - PRODUCTS

2.01 CLEANING MATERIALS

A. Products of the following manufacturers form the basis for design and quality intended.
   1. Prosoco Inc., Kansas City, KS. Product: SURE-KLEAN Light Duty Concrete Cleaner.

B. Or equal as approved in accordance with Division 01, General Requirements for substitutions.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that surfaces to be cleaned are ready for Work of this Section.

B. Beginning of installation means acceptance of existing surfaces and conditions.

3.02 PREPARATION

A. Protect elements surrounding work of this Section from damage.

B. Carefully remove and store fixtures, fittings, finishing hardware, accessories or other items that may be adversely affected by cleaning materials.

C. Close off, areas, materials and surfaces not receiving work of this Section to protect from damage.

D. Provide for thorough ventilation.

3.03 CLEANING EXISTING CONCRETE

A. Cleaning: Minimum percent solution for specific condition of concrete surfaces to remove existing stains, waxes and coatings and leave surface with uniform, natural color and texture.

B. Apply test sections to determine minimum percent solution.

C. Avoid contact with skin and eyes per manufacturer’s instructions.

D. Complete cleaning operation with clean water rinse or special neutralizing rinse to ensure complete removal of all acidic ingredients.

3.04 CLEANING

A. As work proceeds and on completion, remove excess mortar, droppings, smears, stains, efflorescence or other unsightly excess resulting from Work of this Section.

B. Clean surrounding surfaces.

END OF SECTION

SECTION 06 10 00

ROUGH CARPENTRY

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Rough carpentry.

B. Related Section:
   1. Section 01 35 42, CALGreen Requirements.

1.02 REFERENCE STANDARDS

A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.

B. ASTM International
   1. ASTM D 3498 - Adhesives for Field-Gluing Plywood to Lumber Framing for Floor Systems
   2. ASTM D 4601 - Asphalt-Coated Glass Fiber Base Sheet Used in Roofing.
   3. ASTM E 84 - Surface Burning Characteristics of Building Materials.

C. Chapters 7 and 23, 2016 California Building Code, CBC.

D. California Green Building Standards Code, CALGreen - 2016.

E. DOC PS 1-07 - Department of Commerce Product Standard, U. S. Product Standard for Construction and Industrial Plywood.

F. DOC PS 20-05 - Department of Commerce Product Standard, American Softwood Lumber Standards.

G. DOC PS 2-04 - Department of Commerce Product Standard, U. S. Product Standard for Construction, Performance Standard for Wood-Based Structural-Use Panels.

H. ANSI A135.4-1995 - Basic Hardboard.

I. WWPA - Western Lumber Grading Rules 88, Latest Edition, by Western Wood Products Association.

J. HPVA HP-1 – American National Standard Institute, Hardwood Plywood and Veneer Association, 2009 Edition.

K. APA - The Engineered Wood Association. The Construction Guide.

L. AQMD - Local Air Quality Management District Regulations.

M. AWPA C1, C2, C3, C9, C27 - American Wood Preservers Association - Manual of Recommended Practice.

N. AWPA C20-02 - American Wood Preservers Association Standards, Structural Lumber - Fire-Retardant Treatment by Pressure Process.

O. WCLIB - West Coast Lumber Inspection Bureau Standard Grading Rules No. 17.

P. Title 8 - California Code of Regulations, Construction Safety Orders.

Q. ICC - ES - International Code Council Evaluation Service, Inc. Legacy Reports.

R. RIS - Redwood Inspection Service, Standard Specifications for Grades of California Redwood Lumber, 1997.

S. SDAPCD - San Diego County Air Pollution Control District, Regulation IV.

1.03 SUBMITTALS

A. Product data and current ICC Legacy Reports for framing anchors.

B. CALGreen Submittals:
1. Product Data Sheets and Declaration Statements showing compliance with CALGreen Code per 1.04.B.

1.04 QUALITY ASSURANCE

A. California Green Building Standards Code, CALGreen - 2016.
1. Adhesives, sealants, primers, and caulks shall comply with air quality management district rules where applicable, or SCAQMD Rule 1168 VOC limits, per CALGreen Tables 5.504.4.1 and 5.504.4.2.
2. Paints and Coatings shall comply with VOC limits in Table 1 of the ARB, per CALGreen Table 5.504.4.3.
3. Composite wood products (plywood, particle board, medium density fiberboard) shall comply with Formaldehyde limits per CALGreen Table 5.504.4.5.

B. Rough Carpentry Lumber: Visible grade stamp on all products required.

C. Grade Stamp: Association under whose rules it was graded, or official grade mark of other recognized grading agencies using grading rules, equivalent to WWPA or WCLIB.

D. Nailing guns and nail operators shall be approved in accordance with Title 8 Construction Safety Orders.

1.05 DELIVERY, STORAGE AND HANDLING

A. Do not deliver rough carpentry items until site conditions are adequate to receive the Work. Protect items from weather while in transit.

B. Store lumber and plywood at the site under cover or otherwise protected against exposure to weather, raise above ground and out of contact with damp or wet surfaces. Stack lumber and plywood and provide for air circulation within and around stacks and under temporary covers. For pressure treated lumber and plywood, provide spacers between courses to permit air circulation.

C. Install bracing as required. Make proper provision to take care of stresses resulting from construction loads, whenever piles materials, erection equipment or other loads are carried by frame during its erection.

1.06 PROJECT CONDITIONS

A. Cooperate with other trades in coordinating their Work with the Work of this Section. Provide wood grounds, blocking and nailer where indicated or as required for Work of other trades.

PART 2 - PRODUCTS

2.01 ROUGH CARPENTRY MATERIALS

A. Lumber: Graded in accordance with WWPA or WCLIB; maximum moisture content of 19 percent at time of installation. Provide Douglas Fir Larch for structural and framing lumber, surfaced four sides to standards of the grading association unless otherwise indicated on Drawings, use the following grades:
   1. Joists, rafters, beams, lintels, horizontal framing, posts, studs and vertical framing: No. 1 unless otherwise indicated or noted on drawings.
   2. Non-bearing studs and plates, non-structural furring, concealed blocking, stripping and miscellaneous nailers and backing: No. 2 unless noted otherwise in the structural drawings.
   3. Structural Drawings take precedence for lumber grades.
   4. All lumber in contact with concrete shall be pressure treated.

B. Fire-Retardant Treated Wood: Section 2303.2 CBC
   1. Fire-Retardant Douglas Fir Lumber: Lumber shall be grade stamped by an approved agency at the factory, and shall bear identification indicating the fire performance rating thereof, Flame Spread Less than 25, ASTM E84. Lumber: AWPA C20.
   2. Horizontal Exitways: All Occupancy Groups: Class II, except Occupancy Group I: Class I.
   3. Rooms/Areas: All Occupancy Groups: Class III, except Occupancy Groups A and I: Class II.
   4. Other Locations: As indicated on drawings.

C. Nails, Spikes and Staples: Section 2304.10 CBC, Galvanized for exterior applications, high humidity locations and treated wood; plain finish for other interior locations; size and type to suit application. Comply with Table 2304.10.1. Use common nails only.

D. Bolts, Nuts, Washers, Lags, Pins and Screws: Section 2304.10 CBC, sized to suit application, galvanized for exterior locations, high humidity locations and treated wood, plain finish for other interior locations. Full diameter body bolts only per ASME B18.2.1(.2) or B18.2.6 for structural applications.

E. Expansion type or powder actuated type for anchorage to solid masonry or concrete.
   1. Kwik Bolt TZ (KB-TZ) Concrete Anchor, 3/8 to 3/4 inch diameter, ICC ESR-1917, by Hilti Inc., Tulsa, OK, Strong-Bolt concrete anchor, 1/2, 5/8, 3/4 and 1 inch diameter, ICC ESR-1771, by Simpson Strong-Tie, Pleasanton, CA , Or equal with ICC Report Number.
   2. Kwik Bolt 3 (KB3), 1/4 to 3/4 inch diameter, ICC ESR-1385, by Hilti. Wedge-All grout-filled CMU anchor, 3/8, 1/2, 5/8, and 3/4 inch diameter, ICC ESR-1396, by Simpson Strong-Tie. Or equal with ICC Report Number

F. Stock Framing Connectors: Section 2304.10 CBC types indicated on Drawings, galvanized, with nails fully driven in all holes in each face of connector. Conform to the following.
   1. Manufacturers: Simpson Strong Tie Co., Inc., San Leandro, CA, United Steel Products, Montgomery, MN. or equal as approved in accordance with Division 01 General Requirements for Substitutions.
   2. ICC Listed.

G. Non-Stock Framing Connectors: Conform to details.

H. Nonshrink Grout: ASTM C1107, premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 5,000 psi in 24 hours and 8,000 psi in 7 days; of consistency for application and a 30 minute working time. Acceptable Manufacturers: Dayton Superior, Miamisburg, OH; Sonneborn, Shakopee, MN; Novex Systems International, Clifton NJ, or equal.

I. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.

J. Adhesives: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.
   1. Use adhesives that have a VOC content of 50 g/L or less when calculated according to SCAQMD Rule 1168, paragraph (b)(31) or (b)(32).

PART 3 - EXECUTION

3.01 LAYOUT MARKINGS

A. Layout markings shall not be made with xylene-based inks, paint, or dyes, or with other solvent-based products that may bleed through finishes.

3.02 FRAMING, FURRING AND STRIPPING

A. Erect wood framing, furring, stripping and nailing members true to lines and levels. Do not deviate from true alignment more than 1/4 inch in 10 feet, non-cumulative.

B. Construct members of continuous pieces of longest possible lengths.

C. Construct and erect required headers and lintels.

D. Double wall framing members at openings over 100 square inches. Space short members above and below openings in same manner as for walls.

E. Provide double joist headers at joist ends and around openings unless otherwise indicated on Drawings. Bridge joists and rafters to conform Section 2304 CBC and as noted on plans. For pre-manufactured joists, provide bridging in accordance with manufacturer's recommendations.

F. Construct walls with studs of size and spacing indicated, 16 inches on center unless otherwise indicated on drawings. Install single sill member at bottom and double plate at top. Stagger upper and lower members of double plate with joints not less that 4 feet o.c. or as indicated on Drawings. Where sill or any wood member contacts concrete or masonry, install preservative-treated lumber.

G. Provide one row of solid blocking not less than 2 inch nominal thickness and same width of stud at ceiling and floor lines and at spacing not to exceed 8 feet on center vertically. Fit snugly and attach with not less than two 16d nails.

H. Install 3 studs at corners.

I. Conform to Section 2308.5.8, CBC, where pipes penetrate sills or plates.

J. Cutting and Notching: Conform to Section 2308.5.9, CBC.

K. Bored Holes: Conform to Section 2308.5.10, CBC.

L. Conform to Section 718, California Building Code for fire blocks and draft stops. Fire blocks and stops at 10-feet intervals and at ceiling level.

M. Fire-Retardant Wood: Ripping and milling are not permissible. Cross cutting to length, drilling holes, joining cuts and light sanding are permissible. It is not necessary to field treat cut ends to maintain flame spread rating.

END OF SECTION

SECTION 06 20 00

FINISH CARPENTRY - INSTALLATION OF DOORS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Installation of wood and hollow metal doors.

B. Installation of door hardware and attachment accessories.

C. Wood blocking backing and nailers.

D. Related Sections:
1. Section 01 35 42, CALGreen Requirements.
2. Section 08 12 13, Hollow Metal Frames - Welded.
3. Section 08 13 13, Hollow Metal Doors.
4. Section 08 71 00, Door Hardware.
5. Section 09 90 00, Painting.

1.02 REFERENCE STANDARDS

A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.

B. ADA - Americans with Disabilities Act of 1990
1. ADA Standards - ADA Title II Regulations and the 2010 ADA Standards for Accessible Design.

C. APA - The Engineered Wood Association.
1. APA Guide – APA Design and Construction Guide

D. BHMA - Builders Hardware Manufacturers Association
1. BHMA A156.1 through 24 - Standards

E. CBC 2016 California Building Code.

F. California Green Building Standards Code, CALGreen - 2016.

G. CBC - 2016 California Building Code
1. CBC-10 - CBC Chapter 10, Means of Egress
2. CBC - 2016 - CBC Chapter 11B, Accessibility to Public Buildings, Public Accommodations, Commercial Facilities and Publicly Funded Housing

H. CRSC - California Referenced Standards Code (CCR Title 24, Part 12)
1. CRSC-7A.2 - Standard 12-7A-2, Exterior Windows
2. CRSC-10.2 - Standard 12-10-2 Single Point Latching or Locking Devices
3. CRSC-10.3 - Standard 12-10-3 Emergency Exit and Panic Hardware

I. ITS-WH - Intertek Testing Services-Warnock-Hersey

J. PS - U.S. Department of Commerce, Product Standard
   1. PS-1 - Construction and Industrial Plywood
   2. PS-2 - American Softwood Lumber Grading Standards

K. SDI - Steel Door Institute
   1. SDI-107 - Hardware on Steel Doors.
   2. SDI-109 - Hardware for Standard Steel Doors and Frames.
   3. SDI-122 - Installation for Standard Steel Doors and Frames.

1.03 SUBMITTALS

A. CALGreen Submittals:
   1. Product Data Sheets and Declaration Statements showing compliance with CALGreen Code per 1.04.B.

1.04 QUALITY ASSURANCE

A. Acceptable Lumber Grading Associations
   1. PLIB - Pacific Lumber Inspection Bureau
   2. RIS - Redwood Inspection Service, a division of the California Redwood Association
   3. WCLIB - West Coast Lumber Inspection Bureau

B. WWPA - Western Wood Products Association

C. All Plywood shall be free of urea-formaldehyde binders and adhesives.

D. California Green Building Standards Code, CALGreen - 2016.
   1. Adhesives, sealants, primers, and caulks shall comply with air quality management district rules where applicable, or SCAQMD Rule 1168 VOC limits, per CALGreen Tables 5.504.4.1 and 5.504.4.2.
   2. Paints and Coatings shall comply with VOC limits in Table 1 of the ARB, per CALGreen Table 5.504.4.3
   3. Composite wood products (plywood, particle board, medium density fiberboard) shall comply with Formaldehyde limits per CALGreen Table 5.504.4.5.

1.05 DELIVERY, STORAGE AND HANDLING

A. Store materials in ventilated, interior locations.

PART 2 - PRODUCTS

2.01 DOOR MATERIALS

A. Hollow Metal Doors: As specified in Section 08 13 13.

B. Door Hardware: As specified in Section 08 71 00, Door Hardware.

2.02 WOOD MATERIALS

A. Lumber: Douglas Fir, Hemlock, Ponderosa Pine or Sugar Pine species dried to maximum moisture content of 19-percent, visually selected for vertical or mixed grain suitable for transparent finish.
   1. Lumber: PS 20.
   2. Factory mark each piece of lumber with grade stamp of inspection agency indicating grade, species, moisture content at time of surfacing, and mill.

B. Boards for Trim: kiln-dried to maximum moisture content of 15-percent, solid wood surfaced 4 sides (S4S) and one of the following species and grades.
   1. Species: Redwood or Western Red Cedar
   2. Grade
      a. Redwood: RIS, Architectural, Clear
      b. Western Red Cedar: WWPA, C Sel, or equal.

C. Hardwood: kiln-dried to maximum moisture content of 12-percent, and suitable for transparent finish.
   1. Species: White Birch
   2. Grade: Premium, Grade "AA" faces hardwood veneer, sapwood.

D. Plywood: PS 1-07, APA Sanded Plywood Panels, APA, A-C-plugged, Group 1 - Softwood, Exposure - Exterior, with sanded face, and touch sanded back.
   1. Thickness: as indicated on Drawings; if not shown, provide minimum 5/8-inch.

2.03 ACCESSORIES

A. Nails: Size and type to suit application, plain finish.

B. Bolts, Nuts, Washers, Blind Fasteners, Lags, and Screws: Size and type to suit application; plain finish, galvanized when exposed to weather.

C. Primer: 100-percent acrylic resin, water reducible paint suitable as base coat for finish scheduled in drawings and Section 09 90 00.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that openings are ready to receive Work and field measurements are as indicated on shop drawings.

B. Verify mechanical, electrical and building items affecting Work of this Section are placed and ready to receive this Work.

C. Beginning of installation means acceptance of existing conditions.

3.02 INSTALLATION OF HOLLOW METAL DOORS

A. Install doors in accordance with SDI ANSI A250.11/105 and SDI 122 recommendations.

B. Coordinate installation of glass or louvers where indicated.

3.03 INSTALLATION OF HARDWARE

A. Install hardware in accordance with Section 08 71 00, Door Hardware.

B. Exit Devices shall comply with in accordance with CBC 2016 Sections 1008.1.9 and 11B-404.2.7, mounted 34 inches to 44 inches above finish floor, comply with Standard 12-10-3. The unlatching force shall be by Authority having Jurisdiction and may increase the maximum effort to operate doors required to be fire rated to achieve positive latching, but in no case shall the pressure exceed 15 pounds per CBC Section 11B-404.2.9 when applied in the direction of exit travel.

C. Conform to SDI-107 and SDI-109 for hardware on steel doors.

3.04 INSTALLATION TOLERANCES

A. Conform to standard of flatness and squareness as required by SDI-117. Maximum Diagonal Distortion: 1/16 inch measured with straight edge corner to corner, or as required to meet door warranty.

3.05 FIELD QUALITY CONTROL

A. Provide manufacturer's installation instructions for each listed assemblies for review by the Inspection Authority.

3.06 ADJUSTING AND CLEANING

A. Adjust for smooth and balanced door movement.

END OF SECTION

SECTION 06 41 16

CASEWORK

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes
   1. Fabricated base cabinet units.
   2. Fabricated wall units.

B. Related Sections
   1. Section 01 35 42, CALGreen Requirements.
   2. Section 06 61 19, Ultracompact Surfacing Fabrications.

1.02 REFERENCE STANDARDS

A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.

B. ADA - Americans with Disabilities Act of 1990, as amended
   1. ADA Standards - ADA Title II Regulations and the 2010 ADA Standards for Accessible Design.

C. CBC - 2016 California Building Code
   1. CBC Chapter 11B, Accessibility to Public Buildings, Public Accommodations, Commercial Facilities and Publicly Funded Housing
   2. CBC Chapter 16A, Structural Requirements

D. California Green Building Standards Code, CALGreen - 2016.

E. ASCE/SEI 7-10 - American Society of Civil Engineers, Structural Engineers Institute, ASCE Standard.

F. NEMA LD 3 - High Pressure Decorative Laminates: National Electrical Manufacturers Association, 2005 Edition.

G. DOC PS 20 - American Softwood Lumber Standard.

H. DOC PS 1-07 - Department of Commerce Product Standard, U.S. Product Standard for Construction and Industrial Plywood.

I. WI - Woodwork Institute, Architectural Woodwork Standards (AWS), Latest Edition.

J. ANSI A208.1 - Particleboard.

K. ANSI A208.2 Medium-Density Fiberboard-2009.

L. ANSI/HPVA HP-1 - American National Standards for Hardwood and Decorative Plywood.

M. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

N. California Title 17 Division 3 Subchapter 7.5 Air Bourne Toxic Control Measures, Section 93120.1 through 93120.12.

O. SDAPCD - San Diego County Air Pollution Control District, Regulation IV.

1.03 SUBMITTALS

A. Action/Informational
1. Shop drawings including materials, component profiles, fastening methods, assembly methods, joint details, accessory listings and schedule of finishes.
2. Product data.
3. Hardware sample boards identified with the project name, cabinet manufacturer's name and address and one item of each type of hardware specified for installation, on panel of specified color and finish.
a. Additional Finish Samples: If multiple colors and finishes are specified, submit samples of additional colors and finishes on manufacturer’s standard sample size, but not less than 5 by 7 inches.

B. Record
1. Statement of qualification from fabricator.
2. WI Certifications.

C. Closeout
1. Record Documentation

D. CALGreen Submittals:
1. Product Data Sheets and Declaration Statements showing compliance with CALGreen Code per 1.04.L.

1.04 QUALITY ASSURANCE

A. Cabinets shall be manufactured in accordance with Sections 10, 11 and Supplements of the latest edition of the Architectural Woodwork Standards of the Woodwork Institute for Grade specified herein or to higher standards as specified herein.

B. Fabricator Qualifications: A firm experienced in producing architectural woodwork similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. Company specializing in manufacturing the products specified in this section with minimum five years documented experience. Cabinet manufacturer shall be a WI Licensed Fabricator and active member of the Woodwork Institute.
1. Installer shall be WI Certified.

C. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production and installation of interior architectural woodwork with sequence-matched wood veneers including wood doors where veneer matching includes door faces.

D. Before delivery to the jobsite, the casework supplier shall submit a WI Certified Compliance Certificate (Certified Compliance Program) indicating the products furnished for this job, and certifying that they will fully meet all the requirements of the grade or grades specified.

E. Each elevation of casework shall bear a Certified Compliance Label.

F. First page of shop drawings shall bear the WI Certified Compliance Label. Shop drawings not conforming to this requirement will be rejected.

G. Statement shall appear prominently on the shop drawings certifying that all casework construction complies to the structural requirements of to ASCE 7-10, Section 13.5 Table 13.5-1 for required horizontal force factor for anchorage of non-structural components.

H. One (1) copy of the latest issue of the WI AWS shall be made available for reference at the jobsite throughout the installation period.

I. Inspections by Authorized WI inspectors shall be made in accordance with the following schedule:
   1. Shop inspection at place of manufacturer, prior to initial shipment of cabinet components to site.
   2. Site inspection immediately following installation of first cabinet components.
   3. Site inspection immediately following final installation of all cabinet Work.
   4. Additional site inspections may be required at the option of the Architect and at no cost to the Owner when certified WI inspection reports indicate unsatisfactory conformance with specified requirements.
   5. Provide full written reports to Architect.

J. Written confirmation of all WI inspections shall be submitted, including a WI Certified Compliance Certificate for installation.

K. WI Certification costs shall be included.

L. California Green Building Standards Code, CALGreen - 2016.
   1. Adhesives, sealants, primers, and caulks shall comply with air quality management district rules where applicable, or SCAQMD Rule 1168 VOC limits, per CALGreen Tables 5.504.4.1 and 5.504.4.2.
   2. Paints and Coatings shall comply with VOC limits in Table 1 of the ARB, per CALGreen Table 5.504.4.3.
   3. Composite wood products (plywood, particle board, medium density fiberboard) shall comply with Formaldehyde limits per CALGreen Table 5.504.4.5.

M. Pre-installation Conference
   1. Convene two weeks prior to commencing work of this section.

N. Forest Certification: For new wood products, provide materials produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001

O. Mock-up
1. Provide full size base cabinet with countertop and upper cabinet of each casework type indicated, in specified finish with hardware installed. Include pairs of doors for both base and upper cabinet and at least one drawer.
2. Units will establish a minimum standard of quality for this Work.
3. Approved units may be used as part of the Work.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver all materials only when the project is ready for installation and a clean storage has been provided in accordance with the WI Manual of Millwork.

1.06 FIELD MEASUREMENTS

A. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed and indicate measurements on Shop Drawings.
2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.07 COORDINATION

A. Coordinate the work with electrical rough-in and floor finish sections.

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

1.08 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and will maintaining temperature between 60 and 90 deg F and relative humidity between 17 and 50 percent during the remainder of the construction period as recommended by AWS for the location of the project.

1.09 WARRANTY

A. The manufacture shall warrant products from delamination, loose edges, defective or broken hardware, broken casters, loose wood trim, and horizontal or vertical members coming apart from each other and in general against defects in materials and workmanship for 5 years after Substantial Completion.

B. The manufacturer further agrees after delivery date, to repair or replace without charge any woodwork that is defective within the meaning of this warranty. The manufacturer agrees to pay charges for finishing or installing replaced woodwork. This Warranty is not effective if goods are repaired or replaced without first obtaining the manufacturer's written consent.

PART 2 - PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Operable parts for all accessible casework shall comply with CBC Section 11B-309.

2.02 ACCEPTABLE MANUFACTURERS

A. Products of the following laminate materials manufacturers form the basis for design and quality intended.
   1. Wilsonart International, Temple, TX.
   2. Or equal as approved in accordance with Division 01, General Requirements for Substitutions.

2.03 GRADES

A. Provide plastic covered casework in accordance with WI AWS, Section 10 for Custom Grade. ASTM E84, Class B, Flame Spread: Less than 75, Smoke Developed: less than 100.

B. Construction Style: Style A frameless.

C. Construction Type: Type I multiple self-supporting units rigidly joined together.

D. Door and Drawer Front Style: Flush overlay.

2.04 CASEWORK UNITS

A. Casework indicated on drawings shall conform to model Series described below:
   1. Base Cabinets: 100 Series.
   2. Drawer Base Cabinets: 200 Series.
      a. File drawers with built-in steel rail system for hanging folders.
   3. Wall Hung Cabinets: 300 Series.

2.05 LAMINATE MATERIALS

A. Plastic Laminate Cabinet Surfaces: NEMA LD 3, ASTM E84, Class B, Decorative High Pressure Laminate, General Purpose type, 0.028 inch thick at vertical surfaces (VGS), 0.050 inch thick at horizontal surfaces (HGS) and 0.042 inch thick (HGP) for post-formed work. Colors as selected, in wood grains, patterns or solids. Conform to Section 10, WI AWS.

B. Laminate Backing Sheet: NEMA LD 3, High-pressure decorative laminate, BKV Backing Grade, non-decorated high-pressure plastic laminate, with face material of 0.028 inch.

C. Cabinet Liner CLS for cabinet interiors: NEMA LD 3, CLS grade 0.020 inch thick, high pressure decorative laminate.

D. Semi-exposed Areas of Cabinets: High-pressure laminate Cabinet Liner CLS except as specified herein.
   1. Apply Decorative High Pressure Laminate, General Purpose, to all surfaces visible from a seated or standing position, including interior surfaces of open casework, shelving, and casework with glass doors, to sloped tops and to tops up to 72 inches above floor or visible from an upper level.
   2. Apply Decorative High Pressure Laminate, General Purpose, to shelving, horizontal surfaces and all surfaces behind markerboards .

E. Refer to Drawings.
   1. Multiple plastic laminate colors at various horizontal and vertical surfaces as selected by Architect.

2.06 ULTRACOMPACT SURFACING FABRICATIONS

A. Per Section 06 61 19, Ultracompact Surfacing Fabrications.

2.07 WOOD MATERIALS

A. Softwood Lumber: PS 20; Graded in accordance with WI Custom Grade, Douglas Fir, Hemlock, Ponderosa Pine or Sugar Pine.

2.08 CORE MATERIALS

A. Core, the following:
   1. Wood Particleboard: ANSI A208.1, Table A, Grade M-2, 47 lbs/cu.ft. Medium Density Grade, made with water-resistant binder, no added urea formaldehyde permitted, Title 17 CCR.

2.09 ACCESSORIES

A. Contact Adhesives: In accordance with Woodwork Institute for Type II rating, AWS, and specifically approved by WI for the area in which the Project is located. Wilsonart WA H2O, water-based contact adhesive, or equal.

1. Adhesives applied on-site shall comply with VOC content limits defined by SCAQMD Rule 1168.

B. Fasteners: Size and type to suit application.

C. Bolts, Nuts, Washers, Lags, Pins and Screws: Of size and type to suit application.

D. Support angle brackets for countertops: 18" brackets, steel angle 1/4" thick, 2" legs, mitered and welded, ground smooth, unless noted otherwise on drawings, install at 16" on center. Finish: baked enamel, off white.

E. Doorstop Blocks: Nylon type, 1 inch x 1 inch x 2 inches long.

F. Cable Grommets: Molded-plastic grommets 3 inch diameter and matching plastic caps with slot for wire passage, Hafele 429.99, color: black

G. Edge Banding: High Pressure Plastic Laminate, Premium Grade at at cabinet door, drawer. Color to match cabinet faces.

H. Edge Banding for drawer and shelf edges: Premium Grade PVC 3 mm edge banding; at drawers of width to match component thickness, straight edge (no radius). Color as selected by Architect.

I. Wire Management: Mockett WM22A; Description: J-Shape, wire manager with flange fastened under a desk/work surface to route cables. Size: 4-5/16" H x 1-3/32" D x 2-9/16" high trough. Color: Matte black.

2.10 HARDWARE

A. Conform to WI Architectural Woodwork Standards (AWS) and CBC Sections 11B-309 and 11B-225. Any hardware listed therein may be installed, except where those standards are exceeded as described below: "or equals" as substitutions may be submitted in accordance with Division 01 General Requirements.
   1. Drawer Slides: Minimum 100 lb. capacity all drawers. Full extension ball bearing type only, Accuride 3832 Classic for 16 in. wide or less, 7432 full extension 100 lbs rated, ball bearing, for drawers 24 in. wide or less and 3640A full extension 200 lbs rated, for 42 in. wide or less.
   2. Drawer Slides-Lateral files: Minimum 200 lb. capacity all drawers. Full extension ball bearing type only, Accuride 3640A
   3. Wall Cabinet Shelf Standards and Clips:
      a. Flush type Brackets: KV#255BR steel:
         1) Closed shelves Clips: KV #256 clips.
         2) Open shelves Clips: KV#243ZC, let-in and screwed in place, for seismic restraint.
   4. Hinges: Sizes: to fit door and panel thickness.
      a. Institutional heavy-duty Concealed, 3D Clip-On, ANSI/BHMA 156.9 Grade 1, 3/16 inch steel, Aximat 300 Single Pivot, by Hafele America Co. Use Twin overlay hinge 334.06.902 where applicable. Matte nickel finish.
   5. Wire Pulls: "U-shaped", Trimco/BBW No. 562-4, 4 inch satin stainless steel, P2 Series by Terry Hinge.
   6. Locks: 6 pin cylinders:

a. Schlage CL100 all door locks and CL200 all drawer locks, Schlage "C" keyway, 6-pin.
b. Key to match building keying system. Keying: Each room keyed differently . Each Area keyed differently from other Areas of site. "Area" is defined as like room type.

7. Elbow Catches: EPCO 1018 nickel at inactive cabinet door leaf.
8. Magnetic Catches: EPCO 591, all cabinet doors, 5 pound holding strength.
9. Coat Hooks: wall mounted, single; Ives IV581AM. Double: Ives IV582AM, Rockwood or equal. Mount at 44 inches maximum height AFF.
10. Sliding Door Pulls: Wire Pulls, "U" shaped, Trimco/BBW No. 562-4, 4 inch, stainless steel
11. Keyboard and pencil Slide: 75 lb. Accuride 2109, fully adjustable.

B. Finish: US-26D, Dull Chrome (Satin Chromium) plated , unless noted otherwise.

2.11 FABRICATION

A. Shop assemble casework for delivery to site in units easily handled and to permit passage through building openings.

B. When necessary to cut and fit on site, provide materials with ample allowance for cutting.

C. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Make corners and joints hairline. Locate counter butt joints minimum 2 feet from sink cutouts. All patterns to run in the same direction.

D. Install one door stop block screwed on the inside bottom of the inactive leaf to prevent the door from being pushed down to gain entry at all double doors base cabinets. Secure with 2 screws 1-1/2 long at each block.

E. Shop cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Verify locations of cutouts from on-site dimensions. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs. Seal contact surfaces of cut edges.

F. Provide access panels where required to access plumbing and associated casework utilities.

G. Edge Banding: High Pressure Laminate with hot melt adhesive applied, prime before application of adhesive, at cabinet doors.

H. Edge Bandings: Premium Grade PVC 3 mm at drawer and shelf edges.

I. Shelf Loading: 50 lbs. per square foot or 50 lbs. per cubic foot of total volume of cabinet whichever is less. In no case shall unsupported shelf exceed 36" wide without mid support. Conform to Table 1607A.1, California Building Code.

J. Shelf Thickness: 1 inch. All shelf surfaces and edges shall be finished with PVC 3 mm edge for Schools with premium adhesive.

K. Install one grommet per workstation or at every 48 inches of work counter.

PART 3 - EXECUTION

3.01 PREPARATION

A. Verify adequacy of backing and support framing.

B. Layout markings shall not be made with xylene-based inks, paint, or dyes, or with other solvent-based products that may bleed through finishes.

3.02 INSTALLATION

A. Set and secure casework in strict accordance with the WI AWS.

B. Set shelves on specified clips, secure with wood screws each clip, front only. Confirm shelves spacing with Owner, do not proceed without Owner's approval.

C. Casework shall be anchored to walls or floors or both. Conform to ASCE 7-10, Section 13.5 Table 13.5-1 anchorage requirements.
1. Where casework is anchored on 16 gauge steel studs as part of the larger wall or panel: Use 16 gauge steel studs throughout and continuous between perpendicular intersections.

3.03 ADJUSTING AND CLEANING

A. Adjust doors, drawers, hardware, fixtures and other moving or operating parts to function smoothly and correctly.

B. Clean casework, counters, shelves, hardware, fittings and fixtures.

END OF SECTION

SECTION 06 61 19

ULTRACOMPACT SURFACING FABRICATIONS

PART 1 - GENERAL

1.01 Summary

A. Section Includes
   1. Ultracompact surfacing fabrications, countertops.

B. Related Requirements
   1. Section 06 41 16, Casework.

1.02 REFERENCE STANDARDS

A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.

B. ANSI - American National Standards Institute
   1. IAPMO/ANSI Z124.6 - Plastic Sinks

C. ASTM International
   1. C 97 - Absorption and Bulk Specific Gravity of Dimension Stone
   2. C 170 - Compressive Strength of Dimension Stone
   3. C 501 - Resistance to Wear of Unglazed Ceramic Tile by the Taber Abraser
   4. C 880 - Flexural Strength of Dimension Stone

D. NSF International
   1. Certified Products Directory
   2. NSF/ANSI 51 - Food Equipment Materials

E. SDAPCD - San Diego County Air Pollution Control District, Regulation IV.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated

B. Shop Drawings: Show location of each item, dimensioned plans, elevations, and sections, large-scale details, attachment devices, and other components.
   1. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, and other items installed in countertops.

C. Samples
   1. Material: Manufacturer’s standard sample size, but not less than 6 inches square
   2. A minimum 1 foot wide by 6 inch deep, full size sample for each type of counter top indicated, including the edge profile and backsplash.

D. Test and Evaluation Reports: For specified performance criteria, by an independent testing agency

E. Qualification Statements
   1. Fabricator

1.04 QUALITY ASSURANCE

A. Qualifications
   1. Fabricator: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of not less than 5 years of successful in-service performance, with at least one project in the past 5 years where the value of the ultracompact surfacing fabrications was within 20 percent of the cost of ultracompact surfacing fabrications for this Project.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Delivery of surfacing fabrications shall be made only when the area of operation is enclosed, all plaster, concrete work, painting, and similar operations that could damage casework are dry, and the area broom clean.

1.06 FIELD CONDITIONS

A. Do not deliver or install surfacing fabrications until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
   1. Consentino USA Inc. Stafford, TX; Product: Dekton

B. Or equal, as approved in accordance with Division 01 requirements for Substitutions

2.02 PERFORMANCE CRITERIA

A. Moisture Expansion, ASTM C370: 0.02% average.

B. Breaking Strength, ASTM C648:3963 lbf average.

C. Flexural Strength, ASTM C674: 10,828 psi average.

D. Water Absorption, ASTM C373: 0.03% average

E. Flexural Strength: Not less than 5,000 psi, ASTM C 880

F. Abrasion Resistance: Material loss not greater than 225, ASTM C 501

G. Bond Strength, ASTM C482: 423 psi average.

H. Adhesives and sealants shall comply with VOC limits of SDAPCD Rule 1168.

2.03 MATERIALS

A. Material Dimensions: As indicated on Drawings.

B. Proprietary blend of raw materials formed into flat slabs.

2.04 FABRICATION

A. Fabricate components by mold to achieve required shape and configuration. Comply with manufacturer's written recommendations for fabrication.
   1. Fabricate in shop to greatest completion possible; minimize cutting and fitting in the field.
   2. Square edges, and square inside corners, eased, unless indicated otherwise.
   3. Cure components before shipment, except sheet materials requiring site fabrication.

B. Edge Detail: As indicated in Drawings.

2.05 FINISH

A. Pattern and color shall occur, and shall be consistent in appearance, throughout the entire depth (thickness) of the material.

B. Exposed finished surfaces and edges as indicated on Drawings.

C. Styles and Colors: as indicated on Drawings.

2.06 ACCESSORIES

A. Accessory products, as specified below, shall be manufactured by the ultracompact surface fabrication manufacturer or shall be products approved by the ultracompact surface fabrication manufacturer for use with the materials being specified.
   1. Seam Adhesive: Seam adhesive shall be a two-part adhesive kit to create permanent, inconspicuous, non-porous, hard seams and joints by chemical bond between ultracompact surface fabrication materials and components to create a monolithic appearance of the fabrication. Adhesive shall be approved by the ultracompact surface fabrication manufacturer. Adhesive shall be color-matched to the surfaces being bonded where solid-colored materials are being bonded together. The seam adhesive shall be clear or color matched where particulate patterned materials are being bonded together.
   2. Panel Adhesive: Panel adhesive shall be neoprene based panel adhesive meeting TCA Hdbk, Underwriters Laboratories (UL) listed. Use this adhesive to bond ultracompact countertop components to adjacent and underlying substrates.
   3. Silicone Sealant: As specified in Section 07 92 00 and approved for use by the ultracompact surface fabrication manufacturer; use sealant to seal all expansion joints between components and all joints between components and other adjacent surfaces such as walls, floors, ceiling, and plumbing fixtures.
   4. Conductive Tape: Manufacturer's standard foil tape, 0.1 mm 4 mils thick, applied around the edges of cut outs containing hot or cold appliances.

5. Heat Reflective Tape: As recommended by the manufacturer for use with cutouts for heat sources.
6. Mounting Hardware: Provide mounting hardware, including sink/bowl clips, inserts and fasteners for attachment of undermount sinks where specified, and lavatories.

2.07 FABRICATION

A. Components shall be factory or shop fabricated to sizes and shapes indicated, to the greatest extent practical, in accordance with approved Shop Drawings and manufacturer's requirements. Provide factory cutouts for sinks, lavatories, and plumbing fixtures where indicated on the drawings. Contours and radii shall be routed to template, with edges smooth.
   1. Joints and Seams: Form joints and seams between components using manufacturer's approved seam adhesive. Joints shall be inconspicuous in appearance and without voids to create a monolithic appearance.
   2. Edge Finishing: Rout and finish component edges to a smooth, uniform appearance and finish. Rout all cutouts, then sand all edges smooth.

B. Countertops: Fabricate counter top components from 1/2 inch thick material unless indicated otherwise. Counter tops shall be complete with 4 inch high backsplash, permanently attached with coved transition, and loose endsplashes unless indicated otherwise. Attach 2 inch wide reinforcing strip of polymer material under each horizontal counter top seam.
   1. Permanently attached backsplashes shall be attached with seam adhesive and to form a radiused coved transition from countertop to backsplash.
   2. End splashes shall be provided loose for installation at the jobsite after horizontal surfaces to which they are to be attached have been installed

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify existing conditions are complete and ready to receive work of this Section.
   1. Verify that joint preparation, substrates and affected dimensions are acceptable to manufacturer.

3.02 PREPARATION

A. Clean surfaces to receive panels; remove loose and foreign matter that could interfere with adhesion.

3.03 INSTALLATION

A. Install components according to shop drawings and manufacturers instructions.
   1. Install countertops with continous bead of adhesive.
   2. Install with hairline joints.
   3. Fill joints between countertops and adjacent construction with joint sealer; finish smooth and flush.
   4. Align Work plumb and level. Form joints using manufacturer’s recommended procedures. Panel seams should not align with substrate seams.

3.04 TOLERANCES

A. Maximum Variation From True Dimension: 1/8 inch.
   1. Maximum Offset From True Position: 1/8 inch.

3.05 CLEANING

A. Clean and polish fabrications according to manufacturer's instructions.

3.06 PROTECTION OF FINISHED WORK

A. Protect finished work until Date of Substantial Completion.
   1. Do not permit construction near unprotected surfaces.

END OF SECTION

SECTION 07 21 00

INSULATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Sound attenuation insulation in interior partition construction.

B. Related Requirements:
   1. Section 01 35 42, CALGreen Requirements.

1.02 REFERENCE STANDARDS

A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.

B. ASTM - American Society for Testing and Materials
   1. ASTM C 1338 - Test Method for Determining Fungi Resistance of Insulation Materials and Facings
   2. ASTM D 816 - Rubber Cements
   3. ASTM E 84 - Surface Burning Characteristics of Building Materials
   4. ASTM E 96 - Test Methods for Water Vapor Transmission of Materials
   5. ASTM E 136 - Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 degrees C.

C. CBC - 2016 California Building Code
   1. CBC-7 - CBC Chapter 7, Fire and Smoke Protection Features.
   2. Section 120, in conformance with ASTM E-84 or UL 723-Standard for Test for Surface Burning Characteristics of Building Materials.

D. California Green Building Standards Code, CALGreen - 2016.

E. SCAQMD - South Coast Air Quality Management District Regulations Rule 1168 Adhesive and Sealant Applications.

1.03 PERFORMANCE REQUIREMENTS

A. Materials shall provide continuity of sound barrier at designated room enclosure elements.

B. Materials shall conform to Section 720 Thermal and Sound Insulating Requirements, California Building Code and Section 110.8 California Energy Code.

1.04 SUBMITTALS

A. Product Data: Provide data on product characteristics, performance criteria and methods of installation.

B. Three samples of each material specified minimum 12 inches square. Provide fasteners, clips and other accessories.

C. CALGreen Submittals:
   1. Product Data Sheets and Declaration Statements showing compliance with CALGreen Code per 1.05.B.

1.05 QUALITY ASSURANCE

A. California Green Building Standards Code, CALGreen - 2016.
   1. Adhesives, sealants, primers, and caulks shall comply with air quality management district rules where applicable, or SCAQMD Rule 1168 VOC limits, per CALGreen Tables 5.504.4.1 and 5.504.4.2.
   2. Paints and Coatings shall comply with VOC limits in Table 1 of the ARB, per CALGreen Table 5.504.4.3.
   3. Recycled Content: requirements per Section A5.405.4 CALGreen code.

B. Adhesives shall comply with VOC content limits defined by SCAQMD Rule 1168.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products of following manufacturers form basis for design and quality intended.
   1. Johns Manville Insulations, Commercial/Industrial Division, Denver, CO.
   2. Certainteed Corporation, Valley Forge, PA.
   3. Owens - Corning, Toledo, OH.
   4. Thermafiber Division of USG Corp., Wabash, IN.

B. Or equal as approved in accordance with Division 01, General Requirements for Substitutions.

2.02 MATERIALS - SOUND

A. Sound Attenuation Insulation: ASTM C665, Type I; preformed glass fiber, formaldehyde-free, "Sound Control Batts", acoustical fiber glass insulation, by Johns Manville or equal. Conforming to the following:
   1. Size: As required to fully fill cavity width and height.
   2. Thickness: 3-5/8" for 4" walls and 6-1/2" for 6" walls, minimum. 10" thick between floors.
   3. Facing: Unfaced.
   4. Flame Spread: Less than 25, ASTM E84.
   5. Smoke Developed Rating: Maximum 50.
   6. Formaldehyde-free.

2.03 ACCESSORIES

A. Fasteners, type and size to suit application.

B. Tape: Acrylic with Polypropylene backing, Class A, flame spread less than 25, adhering type, 2-1/2 inch wide; No. 8086 CONTRACTOR SHEATHING TAPE, manufactured by 3m Company, St. Paul, MN, or equal as approved in accordance with Division 01, General Requirements for substitutions.

C. Insulation Fasteners: Steel impale spindle and clinch shield on flat metal base with applied adhesive, length to suit insulation thickness, capable of securely and rigidly fastening insulation in place; INSUL-ANCHORS, manufactured by Gemco, Dansville, OH, or equal as approved in accordance with Division 01, General Requirements for substitutions. Self-adhesive base plates are prohibited.

D. Adhesive: Tuff Bond Hanger Adhesive manufactured by Gemco, Dansville, OH, or equal as approved in accordance with Division 01, General Requirements for Substitutions.

E. String wire: Minimum 16 gauge galvanized annealed steel wire spaced at 18" on center.

F. Do not use salvage cut-offs, materials less than space width, or in multiple short lengths to fill-in the gaps.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify site conditions.

B. Verify that substrate and adjacent materials are satisfactorily installed and in place and are ready to receive insulation.

3.02 INSTALLATION

A. Install insulation in accordance with insulation manufacturer's instructions.
   1. Clean tracks prior to installation.

B. Install in cavities designated to receive sound without gaps or voids. Extend material full height of cavity.

C. Cut insulation to fit tightly at cavities between studs not standard 16 inches on center spacing.

D. Trim insulation neatly to fit spaces.

E. Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within the plane of insulation. Leave no gaps or voids.

F. Extend sound materials full height of cavity to structure above and as otherwise required to produce a completely sound insulated enclosure.

G. Wood Framing: Place foil side of thermal batts toward inside of building by stapling at 6 inches oc.
   1. Batts under wood framing: Staple flanges to wood supports at 4" centers and ensure batt facings form continuous vapor barrier. Provide tightly stretched string wires along center of horizontal or sloping batts where support spacing exceed 16" on centers.
   2. Install batts in exterior walls with vapor barrier facing room.

H. Install material to preclude slipping from place by use of nails, screws, wires or other approved fastening devices.

I. Where tight, congested, difficult or otherwise unforeseen conditions are encountered, employ alternate application methods or materials to effect the intended insulation system. Alternate methods or materials shall be submitted to Architect for review and approval..

3.03 INSPECTION

A. Notify Project Inspector before Work is covered. Approval by Project Inspector shall be received before any Work is concealed. Work that has been covered prior to inspection and approval shall be uncovered for inspection and recovered.

END OF SECTION

SECTION 07 25 00

ROOF PATCH & REPAIR

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

B. American Society for Testing and Materials (ASTM):
   1. ASTM A792-96: Specifications for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process

C. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
   1. 1993 Ed.Architectural Sheet Metal Manual, 5 th edition.

D. National Coil Coaters Association (NCCA):

E. Underwriters Laboratories (UL):
   1. UL-790
   2. Tests for Fire Resistance of Roof Covering Materials.

F. Factory Mutual Research (FM):
   1. FM 4470 Approval Standard for Class 1 Panel Roofs.

1.02 SUMMARY

A. Section Includes:
   1. Install new roofing where removed for installation of new equipment and penetrations.
   2. Flash in new curbs and penetrations.
   3. Flash in existing curbs where equipment is removed.
   4. Maintain existing warranty by applying manufacturer materials as required per manufacturer installation requirements.

B. Roofing Terminology: See ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.

1.03 PERFORMANCE REQUIREMENTS

A. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather

without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.

C. Flashings and Fastening: Provide base flashings, perimeter flashings, detail flashings and component materials and installation techniques that comply with requirements and recommendations of the following:
   1. NRCA Roofing and Waterproofing Manual (Fifth Edition) for construction details and recommendations.
   2. SMACNA Architectural Sheet Metal Manual (Fifth Edition) for construction details.

1.04 ACTION SUBMITTALS

A. Product Data and MSDS Sheets: For each type of product specified.

1.05 INFORMATIONAL SUBMITTALS

A. Contractor's Product Certificate: Submit notarized certificate, indicating products intended for Work of this Section, including product names and numbers and manufacturers' names, with statement indicating that products to be provided meet the requirements of the Contract Documents.

B. Qualification Data: For Installer and Roofing Inspector. Include letter from Manufacturer written for this Project indicating approval.

C. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
   1. Submit evidence of compliance with performance requirements.
   2. Indicate that proposed system components are compatible.

D. Warranties: Sample of special warranties.

E. Inspection Reports: Daily reports of Roofing Inspector. Include weather conditions, description of work performed, tests performed, defective work observed, and corrective actions taken to correct defective work.

1.06 CLOSEOUT SUBMITTALS

A. Maintenance Data: For R-Mer Lite Roofing to include in maintenance manuals.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and certified by manufacturer, including a full-time on-site supervisor with a minimum of five years experience.

1. Installer must acquire five inspection service days utilizing manufacturer's technical inspectors.

B. Manufacturer Qualifications: A qualified manufacturer that is UL listed for R-Mer Lite roofing identical to that used for this Project. Or, if the roof is under pre-existing warranty, all products used to be that of the same manufacturer.

C. Source Limitations: Obtain roofing system components from or approved in writing by roofing system manufacturer.

D. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at Project site.
   1. Meet with Owner, roofing Installer, roofing system manufacturer's representative, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
   2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
   3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   4. Review structural loading limitations of roof deck during and after roofing.
   5. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
   6. Review governing regulations and requirements for insurance and certificates if applicable.
   7. Review temporary protection requirements for roofing system during and after installation.
   8. Review roof observation and repair procedures after roofing installation.

E. Preinstallation Roofing Conference: Conduct conference at Project site.
   1. Meet with Owner, roofing Installer, roofing system manufacturer's representative, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
   2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
   3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   4. Review structural loading limitations of roof deck during and after roofing.
   5. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
   6. Review governing regulations and requirements for insurance and certificates if applicable.
   7. Review temporary protection requirements for roofing system during and after installation.
   8. Review roof observation and repair procedures after roofing installation.

1.08 MANUFACTURER'S RESPONSIBILITY

1. All roof panels shall be shipped from the manufacturer with polystyrene or similar cushioned packaging material separating the individual panels to minimize flexing, stressing, scratching or otherwise damaging the material during transit to the job.
2. All steel shall be fully covered during transit by tarpaulins or similar protective cover to prevent dirt and debris from coming in contact with the finished goods.

1.09 INSTALLER'S RESPONSIBILITY:

1. Stack prefinished materials to prevent twisting, bending, abrasion and denting and elevate one end to facilitate moisture run-off.
2. Unload roof panels using a boom or crane, supporting the panels in at least two locations during lifting, and never lift more than three panels at a time.
3. Cover all materials that are moisture sensitive to keep completely protected from the weather.
4. Protect water-based materials from inclement weather.
5. Inspect materials upon delivery. Reject and remove physically damaged or marred material from project site.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
   1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

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

D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.11 JOB CONDITIONS

A. Determine that work of other trades will not hamper or conflict with necessary fabrication and storage and protection requirements for pre-formed metal roofing system.
   1. Protection:
      a. Provide protection or avoid traffic on completed roof surfaces.
      b. Do not overload roof with stored materials.

c. Support no roof-mounted equipment directly on the roofing system.

B. Ascertain that work of other trades which penetrates the roof or is to be made watertight by the roof is in place an approved prior to installation of roofing.

C. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

D. Field measurements and material quantities:
1. Contractor shall have sole responsibility for accuracy of all measurements, estimates of material quantities and sizes, and site conditions that will affect work.

E. Waste Disposal:
1. Do not re-use, re-cycle or dispose of material manufacturers product containers except in accordance with all applicable regulations. The user of manufactured products is responsible for proper use and disposal of product containers.

F. Safety requirements:
1. All application, material handling, and associated equipment shall conform to and be operated in conformance with OSHA safety requirements.
2. Comply with federal, state, local and Owner fire and safety requirements.
3. Maintain a crewman as a floor area guard whenever roof decking is being repaired or replaced.
4. Maintain fire extinguisher within easy access whenever power tools, roofing kettles, fuels, solvents, torches, and open flames are being used.

1.12 WARRANTY

A. Warranty Period: 2 years Contractor Warranty from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 FLAT SEAM ROOFING SYSTEM

A. General
1. Whenever a particular make of material, trade name and/or manufacturer name is specified herein, it shall be regarded as being indicative of the minimum standard of quality required. Additionally, all manufacturer and contractor/fabricator guidelines and performance criteria must be met as specified in article 1.3, 1.4, 1.7, and 1.8.
2. Product names for the metal roof panel system and waterproofing materials used in this section shall be based on performance characteristics of the R-MER LITE II System manufactured by the Garland Company or equal, Cleveland, OH, and shall form the basis of the contract documents. Please contact local representative at 760-815-9333 for more information.

B. If any work to be completed is to a roof under a pre-existing warranty, all products used are to be furnished by the manufacturer of the existing warranty.

2.02 MANUFACTURERS

A. Garland Company, Inc.

B. Or equal as approved in accordance with Division 01, General Requirements for Substitutions.

2.03 MATERIALS

A. Materials
1. Panel Material: Steel sheet, Aluminum-Zinc Alloy Coated, ASTM A792, Coating Designation AZ-50, in thickness of .0157 for field panel, 36 in. by coil, chemically treated, commercial, lock-forming quality. Must meet Title 24 requirements.
2. Steel Framing System: Aluminum-Zinc Alloy Coated, ASTM A792, Coating Designation AZ-50 .0336 by min. chemically treated, commercial, lock-forming quality.
3. Accessory Components: Aluminum-Zinc Alloy Coated, ASTM A792, Coating Designation AZ-50 .0336 or .0217, chemically treated, commercial, lock-forming quality.

B. Steel Finishes
1. Siliconized modified polyester, epoxy primer baked both sides, as approved by finish coat manufacturer.
   a. Property Test Method SMP
   b. Pencil ASTM D-3363 F-H
   c. NCCA II-2
   d. Bend ASTM D-4145 2-T
   e. NCCA II-19
   f. Cross- ASTM D-3359 no loss
   g. Hatch of adhesion
   h. Adhesion
   i. Gloss ASTM D-523 90±5%
   j. (60° angle)
   k. Reverse ASTM D-2794 no cracking
   l. Impact or loss of adhesion
   m. Nominal
   n. Thickness ASTM D-1005
   o. primer 0.2 mils
   p. topcoat 0.8 mils
   q. TOTAL 1.0 mils

C. Accessories:
1. Job Installed In-Seam Sealant: Modified polyisobutylene tape, 3/32" thick by 2" wide, minimum.

a. Seaming material shall be a comprised of a pre-formed, non-hardening polyisobutylene rubber based elastic compound designed for use where space tolerance is limited.
b. Material shall be furnished in a two-sided, moisture-proof, self-adhering tape form that shall accommodate compression, extension, elongation in a form fitting profile without exhibiting memory tendency in order to allow for permanent or semi-permanent surface irregularities or structural expansion/contraction within the system.
c. Elongation: 25% Maximum
d. Recovery: 2% Maximum
e. Solids: 100% Maximum
f. Odor: None
g. Cure Time: Non-Curing
h. Flow: Slight
i. Color: Black or white

D. Adhesion (Metal): Peel: 15l lbs./lin.in. Shear: 55 lbs./in.

E. Seamability: 100% cohesion of mating surfaces

F. Cold Temperature: Passes -30°F. Flex over 1" Mandrelm. Softening Point: 200°F.

G. Factory Applied Sealant:
1. Sealant must consist of a specified hot melt (100% solids thermoplastic material) in a 100% consistent application to affect a permanent, water-tight seal in a full compression configuration.
2. One component urethane meeting 360% elongation (ASTM D 412) and Tear Resistance of 140 lbs/in (ASTM D 1004)
3. One component acrylic terpolymer meeting FS TT-S- 00230.
4. Fasteners:
a. Framing system to plywood: FM 4470 pinch point, fluorocarbon coated #14 fastener.

H. Plywood to Concrete Deck: FM 4470 masonry tip and tread, fluorocarbon coated #14 fastener
1. Seam Screws: Sheet Metal Fastener size #10 or #12 by 3/4"; supplied by roof system manufacturer.
2. Wood Nailers, Curbs and Sleepers: California Redwood, #2 grade. No treated wood utilizing salt-base preservatives shall be allowed. Material safety Data Sheets must be provided to the roofing manufacturer for verification of preserving agents prior to the installation of any pressure treated wood.
3. Miscellaneous Fasteners:
a. TEK #1 or #4 screws
b. Expanding fasteners 1/4" min.
4. Prefabricated Stack Flashings: Flexible pre-fabricated round stack flashings with integrated pressure ring shall be used for all round pipe flashings as furnished by roof system manufacturer.
5. Temporary Night Sealant: Self-contained, two-component urethane foam.
6. Unitized Vents: Spun-aluminum, one way moisture vapor relief vents as furnished by roof system manufacturer.

7. Seam sealer will be White Knight Plus urethane coating applied at the rate of 15 feet per gallon, 3" wide strip, taped off for cleanliness, and supplied by metal roofing manufacturer
8. All materials except for fasteners into deck must be supplied same manufacturer.
9. Drains must be supplied by panel manufacturer. Drains must be one piece welded aluminum and stainless steel with backflow seal connects for protection against drain backups. Drain pan must include drain and overflow drain in same pan.
10. Base flashings: made out of 22 ga Title 24 stucco embossed flat stock from roof manufacturer.
11. Copings: .040 aluminum coping to be fabricated from kynar factory finished flat stock in color chosen by architect. Must have continuous outside cleat and neoprene washered screws on inside edge every 12" O.C. Must be supplied by roof system manufacturer for system edge to edge warranty.
12. Ply sheets: Tri-Base Premium Sheet; Double coated Polyester-Fiberglass-Polyesterscrim with the following minimum performance requirements according to ASTM

I. D5147. Properties (Finished Membrane):
   1. Tensile Strength (ASTM D5147)
      a. 2 in/min. @ 73.4 ± 3.6°F MD 315 lbf/in CMD 315 lbf/in
   2. Tear Strength (ASTM D5147)
      a. 2 in/min. @ 73.4 ± 3.6°F MD 550 lbf CMD 550 lbf
   3. Elongation at Maximum Tensile (ASTM D5147)
      a. 2 in/min. @ 73.4 ± 3.6°F MD 5.0% CMD 6.0%
   4. Insulation: Must be Extruded Polystyrene
      a. Minimum 1.5 lbs/ft density;
      b. To be purchased through roof membrane manufacturer for full system warranty

2.04 FABRICATION

A. In order to maximize quality control and conform to inorganic coating manufacturers; warranty limitations, all roll forming processes shall be done at the manufacturer factory. Absolutely no roll forming will be permitted on the job site.

B. Exercise careful compliance with specified requirements for fabricated profile, dimensional, and structural requirements.

C. Provision shall be made for the roof system to self-ventilate and breathe according to ASTM E241 guidelines.
   1. Ventilation shall be shown to be free-flowing between panels in each contiguous roof area.
   2. Roofing system shall be designed to resist capillary action of water at any slope.

D. Tolerances:
   1. Roof system shall be designed to accommodate normal building dimension tolerances without panel distortion or weaving.
   2. Panels shall not be shimmed to straighten an out-of- line structure.

3. Follow the correct published panel alignment recommendations of the manufacturer without variation.

2.05 SOURCE QUALITY CONTROL

A. Manufacturer shall furnish written documentation that all roof panels, flashing, trim, seam attachment devices, drains, coping, underlayment, insulation, framing members, weather-exposed accessories, tape, caulking and sealants were furnished by this single-source company.

B. Manufacturer shall furnish mill production documentation of specifications for steel coil stock used in the fabrication of the roof system, without organic coating per ASTM A446, ASTM A525, ASTM A527 or ASTM A792.

C. Manufacturer shall furnish all other documentation as required herein.

PART 3 - EXECUTION

3.01 PREPARATION

A. System shall be designed so that the panel installation may be started and/or terminated at any given point in the area. It is understood that the ongoing operations of the Owner are of a critical nature as to leak sensitivity. Do not work on more roof area than can be restored completely watertight in one day.

B. Remove all existing loose material, dirt and debris from the roof area. All accumulations of asphalt or other repair materials shall be removed to provide a relatively level substrate.
   1. Existing metal details and other metal accessories specified for re-use that interfere with the installation of the new roof system shall be carefully removed and set aside for re-use.
   2. Any metal described above that will come in contact with the new roof shall be checked for type and replaced or protected if galvanic action may be a problem.

C. Existing contaminating material must be stripped from all metal components that are indicated to be re-utilized. Care must be taken to protect these metal components and any damaged shall be replaced with new of similar type and dimension.

D. All wood blocks and/or sleepers are to be replaced as part of this project with new treated wood or redwood. Do not use pressure treated wood that contains salt based preservatives or materials corrosive to steel. Material Safety Data Sheets must be provided to the roofing manufacturer for verification prior to installation.

E. Any pipes, conduits or equipment that the Owner determines to be no longer needed shall be removed under this contract.

F. All curbs, soil stacks, and other interior flashing surfaces shall be extended to a minimum of 8" above the new horizontal roof surface or shall be pressure sealed at the top edge.

3.02 INSTALLATION

A. The roof system shall be installed when the atmospheric dry bulb temperature is minimum 40 degrees Fahrenheit and rising.

B. Install all components of the roof system in exact accordance with the manufacturer's standard published procedures as applicable to these project conditions and substrates.

C. The expressed and implied intent of all specifications contained herein shall prevail and take precedent over the manufacturer or any other specifying or associated authority.

D. At any time during the installation, should manufacturer's procedures and these specifications come into unworkable conflict, all work shall be stopped, interested parties notified, and no work shall take place until a resolution is reached.

E. Install all tapered insulation, plywood, and hot asphalt applied underlayment required as detailed below
   1. Over specified concrete pour, install new ½:12 tapered expanded polystyrene (EPS) insulation with 1:12 crickets to maximize water flow in cricket lines to achieve a ¼:12 slope in all valley lines. Over EPS insulation, install 5/8" Struct 1 plywood. Attach plywood to concrete deck and on top of EPS insulation using FM 4470 masonry tip and tread, fluorocarbon coated #14 fasteners with 1" minimum washer. Fasten plywood using a pattern of 11 fasteners in Zone 1 (field), 17 fasteners in Zone 2 (16’ from edge on all sides), and 22 fasteners in zone 3 (overlap of corners from Zone 2).
   2. On top of plywood, loose lay a red rosin paper, and nail a layer of HPR Glasbase base sheet using metal simplex nails. Nail according to FM I-90 wind uplift requirements.
   3. Install 2 layers of HPR Tribase Premium in 25 lbs per square of Type III hot asphalt per layer. Overlap side laps 4" and end laps 8". All layers must wrap up and over parapet walls.
   4. Seal all penetrations to be watertight until metal roofing can be installed. This may need to be periodically touched up to retain watertightness.
   5. Allow other trades to complete work as needed to keep them off of finished R-Mer Lite II metal roofing system. Once other trades are complete, roofing contractor to install R-Mer Lite II roof system over plywood and hot asphalt temporary roofing system.

F. Lay out and anchor all roof framing sections or purlins according to the approved roof plan.

G. Steel framing system installation
   1. The steel framing system shall be installed around the entire perimeter of the roof, all curbs and boxes and as closely to the existing edge and vertical walls as possible.

2. The entire roof area shall then be measured and laid out to determine the designed or practical use of the furnished panels. The framing system shall be installed to the roof surface so that the framing system may be fastened through the existing roof and into the roof deck or structured supports with the entire perimeter of all steel panels covering the fastening flange of the metal framing system. Steel framing sections shall be installed every 6ft as specified by the ASCE 7-5 wind uplift approval.
3. A pre-fabricated drain or ridge line framing system shall be installed along the bottom of all valleys, including along the leading edge of crickets and saddles and along the ridges formed by adjoining slopes in excess of 2" in 12" or as specified.
4. All steel frames, as described above, shall be anchored to the roof deck with FM 4470 pinch point, fluorocarbon coated #14 fasteners every 12" O.C. on each side of the framing, staggered.
5. The adjoining ends of framing sections shall be overlapped. All overlapped adjoining ends shall be fastened to the substrate together. Ends that adjoin or abut the sides of frames shall be lap cut so that there are no gaps between adjoining sections.

H. Install 1.5 ft/lbs density rigid board EPS insulation in between hat channels. Only full sheets of insulation will be accepted. All insulation needs to be secured using plate fasteners.

I. Steel roof membrane installation
1. All panels and other components of the work shall be installed and anchored to the framing supports, making provision for the critical concerns specified below.
2. Seam tape shall be applied to the tops of all framing sections occurring in secondary framing systems, or along leading edge of crickets or saddles, centered along the top of the framing sections. The paper seam tape backer shall be removed
3. The steel roof membrane shall be applied over the framing sections, beginning at the valley or lowest point of the roof, assuring that the panels completely cover the tops of the steel framing sections. The steel panel shall be aligned so that it overlaps the preceding panel by approximately 1-1/2" but does not extend beyond the edge of the top of the underlying framing section.
4. As steel roof panels are being aligned, factory seams of adjacent panels must be staggered a minimum of 6"
5. Seam fasteners may be placed at any point along the steel panels to temporarily anchor them in place, but these fasteners may require removal during the final anchoring process to allow all slack to be removed from the panel.
6. Panel surfaces shall be completely clean of all dirt, debris, oils, and moisture prior to the installation of seam tape. 3/32" thick by 2" wide seam tape shall be applied to the underside of the overlapping portion of adjoining pieces of metal along the scored center line of tape. This will leave 1" of tape exposed. Fold the 1" of exposed butyl tape over the top side of the panel and apply pressure to create a smooth and even seal. End-lap seam tape 1" where necessary. Walk in the seam tape so that tape adheres well to underside and topside of top panel.
7. Remove the underside half of the seam tape paper backer and press the panels together by walking the length of the seam. The topside half of the paper backer is then removed.

8. The compression bar shall be laid on top of the field seam with the lip of the compression bar facing down and setting against the leading edge of the butyl tape exposed on the top side of the roof panel. When laying compression bars a gap of 1/8" shall be maintained between each compression bar. The last hole in adjacent compression bars shall be no further apart that 1" center to center
9. With the installer using 2" X 8" (min.) wood planks to kneel or stand on, the seam fasteners shall be placed approximately 18" O.C., beginning at the middle of the panel and working towards the ends, so that all slack is distributed throughout the length of the panels.
10. Final seaming shall be completed by installing seam fasteners every 1-1/4" O.C. between the stabilizing fasteners. Fastener guns with adjustable clutch shall be used on all fastening panels and accessories. Final seaming is to occur, for all panels installed, at the end of each day.
    a. All seam fasteners shall be set so that the seam is fully compressed, with caution being taken not to over-torque or under-torque the fasteners.
    b. Final seaming shall not be completed at the walls or vertical surfaces until the wall flashing system is installed.
    c. A seam fastener shall be placed in the corner of every panel.

J. Steel flashings installation at curb and wall
1. Factory fabricated wall flashing pieces shall be installed so that the leading edge of the deck flange lines up with the top of the underlying framing section.
2. Seam tape shall be applied to the underside of the wall flashing metal so that approximately 1/8" of tape extends beyond the edge of the metal.
3. The wall flashing piece shall press against the vertical wall with a spring tension action.
4. The final seaming shall be completed by installing seam fasteners every 1" O.C.
    a. 3/32" x 2" Seam tape shall be applied to the underside of the overlapping piece, allowing approximately 1/8" of tape to be exposed beyond the leading edge. The paper seam tape backer shall be removed.
    b. The seamed area of metal shall be pressed onto the underlying section at appropriate overlap, beginning at the vertex of the angle, so that there is no gap where the two pieces adjoin.
    c. The first seam fastener shall be installed directly into the angle, securely anchoring this spot, to the underlying flashing.
    d. All seam fasteners shall be set so that the seam is fully compressed, with caution being taken not to over-torque or under-torque the fasteners.
    e. The heads of the seam fasteners shall never extend beyond the edge of the seam nor occur greater than 1/4" away from the edge of the seam. The adjoining sections of metal shall be seamed together with an overlap a minimum of 2".
    f. The inside and outside corners shall be mitered and shall be installed with seam tape and seam fasteners as described above.
    g. Self adhering underlayment must be installed over parapet walls and lap over base flashings so that water cannot get behind the metal base flashings.

K. Flashing installation at pipes, projections, pitch pans and conduits.
1. All soil stacks shall receive new pre-fabricated unitized stack flashings.

a. The base flange on the unitized flashing shall receive seam tape to the underside of the leading edge of the flange so that approximately 1/8" of tape extends beyond the edge of the metal. The paper seam tape backer shall be removed.
b. The flexible rubber upper portion of the flashing shall be cut to the size of the O.D. of the pipe, as inscribed on the flashing.
c. A bead of caulking shall be applied around the pipe, approximately 2" above the point where the flexible rubber will terminate. The flashing shall then be slid down over the pipe so that the caulking bead is compressed as full contact with the roof is made.
d. A stainless steel pipe clamp shall be installed to the upper seal area of the flexible rubber top.
e. The final seaming shall be completed by installing seam fasteners every 1" O.C. around the base.
f. All seam fasteners shall be set so that the seam is fully compressed, with caution being taken not to over-torque or under-torque the fasteners.
g. The heads of the seam fasteners shall never extend beyond the edge of the seam nor occur greater than 1/4" away from the edge of the seam.

2. All conduits and mechanical lines and pipes shall be installed resting on redwood displacement supports or premade supports as specified in other areas. All copper pipes shall be protected from exposing the roof to galvanic reactions.
a. The conduit or pipe shall be anchored to the wood block with fasteners and brackets of similar metal to that of the pipe.
b. Wood blocks shall be of sufficient size and spacing to adequately support the conduit or pipe above the roof membrane, without bowing. Wood blocks will be installed no further than 4’ O.C.

3. All closed top round flashing shall be flashed with a pre-fabricated wrap-around style unitized flashing.
a. The base flange on the unitized flashing shall receive seam tape to the underside of the leading edge of the flange so that approximately 1/8" of tape extends beyond the edge of the metal. The paper seam tape backer shall be removed.
b. The flexible rubber upper portion of the flashing shall be cut to the size of the O.D. of the pipe, as inscribed on the flashing.
c. A bead of caulking shall be applied around the pipe, at the top of the unitized flashing
d. A stainless steel pipe clamp shall be installed to the upper seal area of he flexible rubber top.
e. The final seaming shall be completed by installing seam fasteners every 1-1/4" O.C. around the base.
f. All seam fasteners shall be set so that the seam is fully compressed, with caution being taken not to over-torque or under-torque the fasteners.
g. The heads of the seam fasteners shall never extend beyond the edge of the seam nor occur greater than 1/4" away from the edge of the seam.

L. Counterflashing installation

1. Prefabricated 22 ga factory finished kynar counterflashings shall be installed as required along all perimeter walls and over all interior flashings that do not have a protective flange covering the top of the baseflashing

2. Seam tape or sealant shall be applied to the back side of the fastening flange of the counterflashing piece. The paper seam tape backer shall be removed.
3. The counterflashing shall be installed in place with appropriate, required fasteners placed 6"-12" O.C. through the center of the fastening flange and anchored so that the flange is secured in place in a spring compression situation. The adjoining sections of metal shall overlap a minimum of 1/2" and a seam fastener shall be installed through both pieces of metal to anchor them to the wall or substrate.
4. A bead of urethane sealant shall be applied to the top edge of the metal, centered over the edge, and tooled to shed water.

M. Metal edge installation

1. If the roof system has been designed for water to drain away from the edge, the metal edge shall be installed after the roof membrane has been installed; if the roof system has been designed for water to flow over the metal edge, the metal edge shall be installed before the roof membrane is installed.
2. If necessary the steel roof membrane shall be cut to be even with the outside edge of the perimeter steel framing section.
3. The metal edge shall be installed with seam tape in place between it and the roof membrane, with the tape exposed approximately 1/8". The open bottom hem of the metal edge shall be used as the outside anchoring cleat. The paper seam tape backer shall be removed.
4. Deck flange on metal edge shall terminate evenly with the inside edge of the top portion of the steel framing section.
5. Install seam tape and seam bar as specified.
6. Metal edge pieces shall be overlapped a minimum of 2", or butted at ends with internal drainage plate or sealed batten cover.

N. Drain flashing installation

1. Fabricated metal sump pan supplied by metal panel manufacturer with integral framing sections shall be installed. One drain pan should be used for both drain and overflow drain.
2. Steel roof membrane shall be cut evenly with the inside edge of the top section of the integral framing section.
3. Seam tape shall be installed to the underside of the roof membrane so that 1/8" shows beyond the leading edge. Paper seam tape backer shall be removed, and tape pressed in place.
4. The final seaming shall be completed by installing seam fasteners, tape, and seam bar as specified.
5. The adjusting nuts on the backflow prevention device shall be adjusted to expand the urethane seal against the inside of the drain leader.
6. The drain strainer shall be installed.

O. Scupper and through-wall termination installation

1. Prefabricated scupper liners shall be installed in place before the wall flashings are installed.
2. Scupper liners shall be large enough to slip through the opening in the wall, and all flanges must fit flush to their corresponding adjoining surfaces.
3. Scuppers shall be anchored in place with appropriate, recommended fasteners placed 4" O.C. and in all corners and transitions.

4. Seam tape shall be installed on the underside of all flashings and membrane terminations at the scupper. The paper seam tape backer shall be removed
5. The final seaming shall be completed using seam bar, tape, and screws as specified.

P. Protective coating installation
1. All excess seam tape shall be trimmed away even with the edge of the lap, using a piece of discarded sheet metal rounded-off as a knife (do not use utility knives).
2. After all work is complete and the roof has been inspected and approved by the material manufacturer and the owner, a protective coating shall be applied to all seam areas at the rate of 30 feet per gallon.
3. Protective coating (White Knight Plus) shall be applied to all inside and outside corner seams, along the tops of seams in projections, and around all sump pan and through wall scupper seams, etc. This should cover all screws.
4. Protective coating (White Knight Plus) shall be applied to all field seam, blind seam and other mechanically fastened areas, and over all caulking applications. Tape will be used to mask off all seam to ensure that all seams are straight. Tape must be removed immediately and cannot be on the metal for more than 24 hours.

END OF SECTION

SECTION 07 84 00

FIRESTOPPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Firestopping systems, products, materials and accessories.

B. Through-penetration firestopping systems.

C. Firestopping at intersections of fire-rated partitions and horizontal assemblies.

D. Related Section:
1. Section 01 35 42, CALGreen Requirements.

1.02 REFERENCE STANDARDS

A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.

B. ASTM E84 - Surface Burning Characteristics of Building Materials.

C. ASTM E814 - Fire Tests of Through-Penetration Firestops.

D. ASTM E119 - Fire Tests of Building Construction and Materials.

E. ANSI/UL 2079-98 - Tests for Fire Resistance of Building Joint Systems.

F. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

G. ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barrier System Using Intermediate-Scale, Multi-story Test Apparatus.

H. UL Fire Resistance Directory, Latest Edition.

I. UL Fire Resistance Directory for Perimeter Fire Containment System per UL XHDG and UL XHGU.

J. UL 1479 - Fire Tests of Through-Penetration Firestops.

K. UL 2079 Tests for Fire Resistance of Building Joint Systems.

L. Chapter 7, 2016 California Building Code.

M. California Green Building Standards Code, CALGreen 2016.

1.03 SUBMITTALS

A. Product Data: Provide data on product characteristics, performance and limitation criteria.

B. CALGreen Submittals:
1. Product Data Sheets and Declaration Statements showing compliance with CALGreen Code per 1.04.B.

C. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.

D. UL approval numbers for firestopping materials, devices and systems.

E. State approvals for firestopping materials and devices and systems.

1.04 QUALITY ASSURANCE

A. Qualifications
1. Manufacturer: Company specializing in manufacture of products specified in this Section, with minimum five years' experience.
2. Installer Qualifications: A firm that has been approved by either FMG or UL.
a. FMG 4991, "Approval of Firestop Contractors."
b. UL, "Qualified Firestop Contractor" program.
c. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its through-penetration firestop system products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

B. California Green Building Standards Code, CALGreen 2016.
1. Adhesives, sealants, primers, and caulks shall comply with air quality management district rules where applicable, or SCAQMD Rule 1168 VOC limits, per CALGreen Tables 5.504.4.1 and 5.504.4.2.
2. Paints and Coatings shall comply with VOC limits in Table 1 of the ARB, per CALGreen Table 5.504.4.3

C. Regulatory Requirements
1. Conform to Sections 714, 715 and 720.1, 2016 CBC for fire resistance standards and requirements for penetrations and joint systems in walls, partitions, floor-ceilings and roof-ceilings.
2. Firestop Systems installation shall meet requirements of ASTM E814, UL 1479, or UL 2079 tested assemblies that provide fire rating equal to that of construction being penetrated.
3. Maintain one copy of current UL Fire Resistance Directory Listings, on jobsite at all times.
4. Firestopping systems shall meet temperature limitations as described in ASTM E119 and hose stream exposure as described in ASTM E814.

5. Firestopping system components shall consist of materials exhibiting limited combustibility, and shall have an oxygen index greater than 40 when tested in accordance with ASTM D2863. The flame spread rating shall be a maximum of 20 when tested in accordance with ASTM E84.
6. Firestopping system components shall have low smoke producing characteristics (less than 200) when tested in accordance with ASTM E84.
7. Electrical Boxes shall meet the requirements of UL 514.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Do not apply materials when temperature of substrate material and ambient air is below manufacturer's minimum recommendations.

B. Maintain ambient air temperature above this minimum temperature before, during and for 3 days after installation of materials.

C. Provide ventilation in areas to receive solvent cured materials.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type, and UL label where applicable.

B. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.

C. Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements.

D. Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.

E. Do not use damaged or expired materials.

1.07 SEQUENCING

A. Sequence Work to permit firestopping materials to be installed during or after adjacent and surrounding Work is complete.

PART 2 - PRODUCTS

2.01 GENERAL

A. Manufacturers, products and systems as listed in UL Fire Resistance Directory, are approved for use under this Section:
1. Through-Penetration Firestop Systems, (XHEZ) Field-Erected Type.
2. Fill, Void or Cavity Materials (XHHW), Installed at Jobsite.
3. Firestop Devices (XHJI), Factory Built Systems.
4. Forming Materials (XHKU) Jobsite Applied.
5. Through-Penetrating Products (XHLY) Cable, Conduit, Pipe and Tubing.
6. Joint Systems (XHBN) showing Class II and Class III movement capabilities.

7. Perimeter Fire Containment Systems per XHDG and XHGU.

B. Manufacturers, products and systems as listed in the WHI Certification Listings, are approved for use under this Section:
   1. Through-Penetration Firestop Systems: Listed in "Firestop Systems" Section.

C. Materials and devices utilized in the above referenced systems shall be used only in those systems in which they were tested. Substitutions are not permitted.

D. Or approved equal systems in compliance and listed in the UL Directory.

2.02 APPROVED FIRESTOPPING SYSTEMS

A. 3M Inc., St Paul, MN www.3m.com/firestop
   1. Sealants, caulking, or spray materials used for openings between structurally separate sections of wall and floors, and top of wall conditions. Following products are acceptable:
      a. 3M IC 15WB+ intumescent sealant.
      b. 3M CP25WB+ intumescent sealant.
      c. 3M FireDam 150+ acrylic latex sealant.
      d. 3M Fire Barrier Mortar. Firestop Mortar.
      e. 3M Fire Barrier 3000WT Water Tight Silicone Sealant
      f. 3M FireDam Spray 200
      g. Equivalent products listed in the U.L. Fire Resistance Directory – Volume 2
   2. Sealants, caulking or spray materials for use with fire-rated construction joints, edge of slab perimeter joints, and other gaps. Following products are acceptable:
      a. 3M FireDam Spray 200
      b. 3M FireDam 150+ acrylic latex sealant.
      c. 3M Fire Barrier 1000 NS Silicone Sealant
      d. 3M Fire Barrier 1003 SL Silicone Sealant
      e. Equivalent products listed in the U.L. Fire Resistance Directory – Volume 2A, 2B.
   3. Cast-in place firestop devices for use with noncombustible and combustible pipes (closed and open systems), conduit, and cables bundles penetrating concrete floors, following products are acceptable:
      a. 3M Fire Barrier Cast-in place MCID firestop device for use with Metallic penetrants
         1) Add Aerator adaptor when in used in conjunction with aerator (solvent) system.
      b. 3M Tub Box Kit for use with tub installations.
      c. 3M Fire Barrier Cast-in place PCID firestop device for use with noncombustible penetrants.

B. Hilti Inc., Tulsa, OK.
   1. Sealants, caulking, or spray materials used for openings between structurally separate sections of wall and floors, and top of wall conditions. Following products are acceptable:
      a. Hilti CP 672 Firestop Spray
      b. Hilti CP 601s Elastomeric Firestop Sealant
      c. Hilti CP 606 Flexible Firestop Sealant
      d. Hilti CP 637 Firestop Mortar.

e. Equivalent products listed in the U.L. Fire Resistance Directory – Volume 2

2. Sealants, caulking or spray materials for use with fire-rated construction joints, edge of slab perimeter joints, and other gaps. Following products are acceptable:
   a. Hilti CP 672 Firestop Spray
   b. Hilti CP 601s Elastomeric Firestop Sealant
   c. Hilti CP 606 Flexible Firestop Sealant
   d. Equivalent products listed in the U.L. Fire Resistance Directory – Volume 2A, 2B.
3. Cast-in place firestop devices for use with noncombustible and combustible pipes (closed and open systems), conduit, and cables bundles penetrating concrete floors, following products are acceptable:
   a. Hilti CP 680 Cast-in place firestop device.
      1) Add Aerator adaptor when in used in conjunction with aerator (solvent) system.
   b. Hilti CP 681 Tub Box Kit for use with tub installations.
   c. Hilti CP 682 Cast-in place firestop device for use with noncombustible penetrants.
4. Firestop Devices: Factory-assembled steel collars lined with intumescent material sized to fit specific outside diameter of penetrating item, the following products are acceptable:
   a. Hilti CP 643N Firestop Collar
5. Fire Rated Cable Pathways: Hilti Speed Sleeve Brand device modules comprised of steel raceway with intumescent foam pads allowing 0 to 100 percent cable fill, the following products are acceptable:
   a. Hilti CP 653 Speed Sleeve
6. Firestop Drop-In-Device: Hilti Drop-In-Device Brand devices used with noncombustible and combustible pipes (closed and open systems), penetrating concrete floors, the following products are acceptable:
   a. Hilti CFS DID (Drop-In-Device)
7. Wall Opening Protective Materials: Intumescent, non-curing pads or inserts for protection of electrical switch and receptacle boxes to reduce horizontal separation to less than 24", the following products are acceptable:
   a. Hilti Firestop Box Inserts
   b. Hilti CP 617 Puddy Pads
8. Firestop Putty: Intumescent, non-hardening, water resistant putties containing no solvents, inorganic fibers or silicone compounds, the following products are acceptable:
   a. Hilti CP 618 Puddy Stick
9. Wrap Strips: Single component intumescent elastomeric strips faced on both sides with a plastic film, the following products are acceptable:
   a. Hilti CP 648S Firestop Wrap Strip
   b. Hilti CP 648E Firestop Wrap Strip
10. Firestop Block: Re-enterable, non-curing, intumescent flexible 2 component polyurethane foam block, the following products are acceptable:
    a. Hilti CP657 Fire Block
11. Mortar: Portland cement based dry-mix product formulated for mixing with water at Project site to form a non-shrinking, water-resistant, homogenous mortar, the following products are acceptable:
    a. Hilti CP 637 Firestop Mortar

12. Silicone Foam: Multicomponent, silicone-based liquid elastomers, that when mixed, expand and cure in place to produce a flexible, non-shrinking foam, the following products are acceptable:
    a. Hilti CP 620 Fire Foam
13. Composite Sheet: Intumescent material sandwiched between a galvanized steel sheet and steel wire mesh protected with aluminum foil, the following products are acceptable:
    a. Hilti CP 675T Firestop Board
14. Firestop Plugs: Re-enterable, foam rubber plug impregnated with intumescent material for use in blank openings and cable sleeves, the following products are acceptable:
    a. Hilti CP 658T Firestop Plug

C. Smoke and Acoustical sealants: Specified in Section 07 92 00.

D. Color: White color where exposed to public.

E. Or equal in accordance with Division 01, General Requirements.

2.03 FIRESTOPPING AT ELECTRICAL BOXES AND UTILITY OUTLETS

A. Steel electrical outlet boxes on opposite sides of walls requiring protected openings shall be separated by horizontal distance of 24 inches.

B. Steel electrical outlet boxes that occur in combination with outlet boxes of size such that aggregate area of unprotected outlet boxes exceeds 100 square inches in any 100 square feet of wall area shall be protected by approved material or detail to decrease aggregate area of unprotected utility boxes to less than 100 square inches in any 100 square feet of wall.

C. Steel electrical outlet boxes that do not exceed 16 square inches in area shall be protected by an approved firestop material: at each side of wall:
1. CP 617 and CP 617L MOLDABLE FIRESTOP PUTTY PADS, by Hilti Inc. Tulsa, OK
2. MPP-4S MOLDABLE PUTTY PADS, by 3M Contractor Products, Minneapolis, MN.
3. FSP FIRESTOP PUTTY PADS, by Hevi-Duty Nelson Products, Tulsa, OK.
4. SPECSEAL PUTTY PADS, By Specified Technologies, Inc., Somerville NJ.
5. Johns Manville, Denver CO. Firetemp Puddy Pad.
6. Or equal as approved in accordance with Division 01, General Requirements for Substitutions.

D. Utility and electrical outlets or boxes shall be securely fastened to the stud or framing of the wall, or ceiling assembly. The opening in the gypsum board facing shall be cut so that the clearance between the box and the gypsum board does not exceed 1/8 inch.
1. In smoke walls the 1/8 inch clearance shall be filled with an approved fire-rated sealant.

2.04 ACCESSORIES

A. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.
   1. Permanent forming/damming/backing materials.
   2. Substrate primers.
   3. Collars.
   4. Steel sleeves.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify site conditions.

B. Verify that openings are ready to receive Work of this Section.

3.02 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material or other matter that may affect bond of firestopping material.

B. Remove incompatible materials that affect bond.

C. Install backing materials to arrest liquid material leakage.

3.03 APPLICATION

A. Install fluted through penetration firestopping system per Section 09 22 16 [05 40 00].

B. Apply primer, firestop sealant or other firestop materials in accordance with manufacturer's recommendations and as approved by regulatory agencies. Apply at voids between fire-rated assemblies and adjoining fire-rated materials or assemblies.

C. Apply firestopping materials with sufficient thickness or configuration to achieve designated fire rating.

D. Install firestopping material in locations where designated fire rating must be maintained, including, but not limited to following:
   1. Voids or annular openings around sleeves, piping, ductwork or electrical/communications conduits that penetrate fire rated walls, partitions, floors, ceilings or assemblies.
   2. Intersections of fire-rated vertical and horizontal assemblies, including but not limited to door and window frames.

E. Remove dam material after firestopping material has cured.

3.04 IDENTIFICATION

A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375-inch strokes.
   1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet from end of wall and at intervals not exceeding 30 feet.

3.05 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.06 PROTECTION OF FINISHED WORK

A. Protect finished Work.

B. Protect adjacent surfaces from damage by material installation.

3.07 INSPECTION

A. Notify Inspector before Work is covered. Approval of Inspector shall be received before any Work is concealed in manner that will make inspection difficult. Work that has been covered prior to inspection and approval shall be uncovered, inspected and recovered.

END OF SECTION

SECTION 07 92 00

JOINT SEALANTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Preparing substrate surfaces.

B. Sealant and joint backing.

C. Related Section:
1. Section 01 35 42, CALGreen Requirements

1.02 REFERENCE STANDARDS

A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.

B. ASTM C834 - Latex Sealing Compounds.

C. ASTM C881 - Epoxy-Resin Base Bonding Systems for Concrete.

D. ASTM C919 - Use of Sealants in Acoustical Applications.

E. ASTM C920 - Elastomeric Joint Sealants.

F. ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.

G. ASTM C1184 - Structural Silicone Sealant.

H. ASTM C1193 - Standard Guide for Use of Joint Sealants.

I. ASTM C1311 - Solvent Release Sealants. Butyl and acrylic base polymer.

J. ASTM C1330 - Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants.

K. ASTM C1635 Standard Test Method to Evaluate Adhesion/Cohesion Properties of a Sealant at Fixed Extensions

L. SWRI (Sealant, Waterproofing and Restoration Institute) - Sealant and Caulking Guide Specification (www.SWRIONLINE.org).

M. GANA: Glass Association of North America Sealant Manual, 2008.

N. California Green Building Standards Code, CALGreen - 2016.

O. SDAPCD - San Diego County Air Pollution Control District, Regulation IV.

1.03 SUBMITTALS

A. Product Data: Provide data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.

B. CALGreen Submittals:
1. Product Data Sheets and Declaration Statements showing compliance with CALGreen code per 1.04.E.

C. Manufacturer's installation Instructions: Indicate special procedures, surface preparation, and perimeter conditions requiring special attention.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Perform acoustical sealant application work in accordance with ASTM C919.

C. Prepare sample joints in the construction to demonstrate to the Architect the quality of the Work to be performed. Accepted sample joints will be used to judge the quality of the Work.

D. Qualifications
1. Manufacturer: Company specializing in manufacturing the Products specified in this Section with minimum three years' experience.
2. Applicator:
   a. Pre-qualified applicator specializing in performing Work of this Section with minimum three years' experience and approved by manufacturer.
   b. This applicator shall be licensed joint sealing specialty Contractor.
   c. Submit list of completed local projects of similar sealant applications.

E. California Green Building Standards Code, CALGreen - 2016.
1. Adhesives, sealants, primers, and caulks shall comply with air quality management district rules where applicable, or SCAQMD Rule 1168 VOC limits, per CALGreen Tables 5.504.4.1 and 5.504.4.2.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.06 COORDINATION

A. Coordinate the Work with all Sections referencing this Section.

1.07 WARRANTY

A. Provide five-year product warranty, submit under provisions of Division 01, General Requirements.

B. Provide two-year installer's warranty, submit under provisions of Division 01, General Requirements.

C. Warranty: Include coverage for installed sealants and accessories which fail to achieve air tight seal, water tight seal, exhibit loss of adhesion or cohesion, or do not cure.

D. Upon written notification of failure due to defective materials or application, repair or replace failure to the approval of the Architect and at no cost to Owner.

PART 2 - PRODUCTS

2.01 SEALANT AND MATERIAL MANUFACTURERS

A. Following is list of acceptable manufacturers of sealants and sealant materials. Inclusion in this list is not intended to imply that all manufacturers make all products. Products made by listed manufacturers must comply with all specified requirements.
1. Bostik Construction Products.
2. Dow Corning Corporation (www.dowcorning.com/construction)
3. Sika Corporation.
4. General Electric Company.
5. W.R. Meadows, Inc.
6. Pecora Corporation.
7. Mameco International.
8. Tremco/Vulkem.
9. Sonneborn, ChemRex Inc.
10. Hilti
11. 3M Company

B. Substitutions: Under provisions of Division 01, General Requirements.

2.02 SEALANT TYPES

A. Single-Component Urethane: ASTM C 920, Type S, Grade NS, Class 35, Use NT, A, M, and O; USDA and FDA status.

B. Single-Component Urethane (Self-Leveling): ASTM C 920, Type S, Grade P, Class 35, Use T, A, M.

C. Multi-Component Urethane (Gun-Grade): ASTM C 920, Type M, Grade NS, Class 35, Use NT, A, M, and O.

D. Multi-Component Polyurethane (Gun-Grade): ASTM C 920, Type M, Grade NS, Class 35, Use T, A, M, and O.

E. Multi-Component Urethane (Self-Leveling): ASTM C 920, Type M, Grade P, Class 25, Use T, A, M, and O.

F. Single-component sealant, Silicone (Neutral-curing): ASTM C 920, Type S, Grade NS, Class 35, Use NT, G, A, M, and O; USDA, NSF and FDA 21 CFR 177.2600 approved.

G. Single-component sealant, Silicone (Neutral-curing,): ASTM C 920, Type S, Class 100/50, Grade P, Use T, and O.

H. Single-component, modified silicone polymer (silyl-terminated polyether resin - STPe), elastomeric sealant with plus-100-percent to minus-50-percent movement and complying with ASTM C-920, Type S, Grade NS, Uses NT, G, M, A, and O.
   1. Acceptable Product: BASF, Sonolastic 150 Tint Base, or equal. Color shall be as selected by the Architect from the manufacturer's full range of available colors.

I. Acrylic-Latex Caulk: ASTM C 834, Type OP or C, Grade 18 deg. C.

J. Bedding Compound: For installation of thresholds and similar items indicated to be bedded in sealant, use a preformed butyl-polyisobutylene sealant tape. Size of tape as required for the specific application.

K. Adhesives: Type that complies with Mil. Spec. MIL-A-46146
   1. Product: Dow Corning 3145 Silicone Adhesive
   2. Color: Clear or Translucent.
   3. Peel Strength: 75

L. Butyl Sealants: Butyl rubber sealant, BC-158 by Pecora or equal in compliance with VOC regulations of local Air Quality Districts.

2.03 JOINT AND SURFACE TYPES

A. Pedestrian and Vehicle Traffic Joints - Provide one of the following for each joint type:
   1. Multi-component urethane (self-leveling)
   2. Single-component urethane (self-leveling)
   3. Single-component sealant, silicone (neutral curing)

B. Non-Traffic Deck Joints - Provide one of the following for each joint type:
   1. Multi-component urethane (gun-grade)
   2. Single-component urethane
   3. Single-component sealant, silicone

C. Vertical Joints - Provide one of the following for each joint type:
   1. Multi-component urethane (gun-grade)
   2. Single-component sealant, silicone (neutral cure)

D. Expansion, Control, and Perimeter Joints - Provide one of the following for each joint type:
   1. Multi-component urethane (self-leveling)
   2. Single-component urethane; use only where dynamic movement will not exceed 50 percent of joint width - above or below grade
   3. Single-component urethane (self-leveling)
   4. Single-component sealant, silicone.

E. Food Service Areas: Sealant complying with FDA requirements for use in food areas - Provide one of the following for each joint type:
   1. Single-component urethane
   2. Single-component silicone (neutral-curing)
   3. Single-component silicone (acid cure)

F. Interior Doors - Provide one of the following for each joint type:
   1. Single-component sealant, silicone (neutral cure)

G. Built-In Cabinet Work: In kitchen, toilet, and bath areas, as specified for those areas. In other areas, single-component silicone (neutral-curing) or acrylic-latex caulk.

H. Miscellaneous locations: Butyl rubber at all gaps, holes, openings, under wood sills, penetrations or channel metal track in exterior envelope of building not identified herein. Install as directed by the Architect.

I. Seal all cutouts and penetrations: For electrical, mechanical, plumbing and structural framing cutouts and penetration at interior surfaces with acoustical sealant or butyl rubber for exterior surfaces including walls.

2.04 SEALANT COLORS

A. Provide materials matching colors indicated or if no color is indicated, matching the color samples selected from those submitted to the Architect.
   1. Sealant between walls and door, window, and louver frames to match adjacent wall color.

2.05 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Joint Backing Rod: ASTM C1330 Class C, closed cell polyethylene cylindrical backer rod; oversized 30 to 50 percent larger than joint width, Green Rod by Nomaco Inc., Zebulon, NC, Backer Rod Mfg. Denver, CO or equal.

D. Elastomeric Tubing Sealant Backing: ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.

E. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

F. Filler: Mineral fiber board; ASTM C612, Class1, thickness same as joint, depth to fill void completely behind backer-up rod.

G. Tape Sealants: pressure sensitive, 100% solid, sealing tape with a release paper backing. Provide permanent elastic, non-sagging, non-toxic, non-staining tape sealant. Schnee-Morehead Inc. "Tacky Tape" SM5227, 3/32" or 1/2" wide x 3/8" thick x 45' long, or equal.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces and joint openings are ready to receive Work.

B. Verify that joint backing and release tapes are compatible with sealant.

3.02 PREPARATION

A. Remove loose materials and foreign matter which might impair adhesion of sealant.

B. Clean and prime joints in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions.

D. Protect elements surrounding the Work of this Section from damage or disfiguration.

E. At deep joints install filler material to fill space behind the back-up rod and position the rod at proper depth.

3.03 INSTALLATION

A. Do not proceed with sealant Work until the sample joints specified in Part 1 of this Section have been prepared and accepted by the Architect.

B. Install sealant in accordance with manufacturer's instructions and ASTM C1193.

C. Apply sealant per ASTM C919 at gypsum board framed sound walls, side of runners in metal framing and miscellaneous openings and cutouts.

D. Measure joint dimensions and size materials to achieve required 2:1 width/depth ratios.

E. Install joint backing to achieve a neck dimension no greater than 1/3 of the joint width.

F. Install bond breaker where joint backing is not used.

G. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

H. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

I. Tool joints concave unless detailed otherwise.

3.04 CLEANING

A. Clean adjacent soiled surfaces.

3.05 PROTECTION OF FINISHED WORK

A. Protect finished installation under provisions of Division 01, General Requirements.

B. Protect sealants until cured.

END OF SECTION

SECTION 08 12 13

HOLLOW METAL FRAMES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Non-rated Welded steel frames for doors .

B. Related Sections
1. Section 06 20 00, Finish Carpentry - Installation of Doors.

1.02 REFERENCE STANDARDS

A. Conform to reference standards by date of issue current on date of Contract Documents.

B. SDI - Steel Door Institute.
1. SDI 100 - Recommended Specifications for Standard Steel Doors and Frames, Latest Edition.
2. SDI 111 - Recommended Standard Details Steel Doors and Frames.
3. SDI 117 - Manufacturing Tolerances Standard Steel Doors and Frames.

C. ANSI - American National Standards Institute
1. ANSI A250.4 and A450.5 - Test Procedure / Acceptance Criteria for Physical Conformance.
2. ANSI A250.6- Hardware on Steel Doors (Reinforcement Applications).
3. ANSI A250.8/SDI-100 - Recommended Specifications for Standard Steel Doors and Frames, Latest Edition.
4. ANSI A250.10 - Test Procedure and Acceptance Criteria for Prime Steel Surfaces for Steel Doors and Frames.
5. ANSI A250.11/SDI-105 - Recommended Erection Instructions for Steel Frames.

D. ASTM - American Society for Testing and Materials
1. ASTM A653 - Sheet Steel, Zinc-Coated (Galvanized) or Zinc - Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
2. ASTM A924 - General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
3. ASTM A1008 - Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
4. ASTM D6386 - Preparation of Hot-Dipped Galvanized Coated Iron and Steel and Hardware Surfaces for Painting.

E. ADA - Americans with Disabilities Act of 1990, as amended.
1. ADA Standards – ADA Title II Regulations and the 2010 ADA Standards for Accessible Design.

F. CBC - 2016 California Building Code.

G. CRSC - California Referenced Standards Code (CCR Title 24, Part 12)
   1. CRSC-10.2 - Standard 12-10-2 Single Point Latching or Locking Devices
   2. CRSC-10.3 - Standard 12-10-3 Emergency Exit and Panic Hardware

H. AWS - American Welding Society
   1. AWS A2.4 - Standard Symbols for Welding, Brazing and Non Destructive Examination
   2. AWS A5.1 - Carbon Steel Electrodes for Shielded Metal Arc-Welding
   3. AWS A5.5 - Low Alloy Steel Electrodes for Shielded Metal Arc-Welding
   4. AWS B2.1 - Welding Procedure and Performance Qualification
   5. AWS D1.1 - Structural Welding Code, Steel
   6. AWS D1.3 - Structural Welding Code, Sheet Steel

1.03 SUBMITTALS

A. Shop drawings indicating frame configuration, anchor types and spacing, location of cutouts for hardware, reinforcement and finish.

B. Product data.

C. Manufacturer's installation instructions.

D. Job Closeout: provide one complete manufacturer’s catalog to Owner’s lock shop or Authorized Representative.

1.04 QUALITY ASSURANCE

A. Manufacture frames to conform to SDI standards except where exceeded by this Specification.

B. Comply with ANSI/SDI A250.4 Level A, one million cycle swing test performance for 3070 door frames.

C. Manufacturer: Company specializing in manufacturing products specified in this Section having minimum five (5) years experience.

D. Installer: Firm with minimum five (5) years experience in installation of metal doors and frames.

1.05 DELIVERY, STORAGE AND PROTECTION

A. Deliver and protect frames with manufacturer's shipping safeguards.

B. Attach spreader bars on welded frames to preclude warping or bending during delivery and storage.

C. Storage: Store in dry secure location. Place units on minimum 4 inch high wood blocking. Avoid non-vented plastic or canvas shelters. Provide 1/4 inch wide spaces between stacked units.

1.06 WARRANTY

A. One-year warranty against defects in materials and workmanship. Warranty to commence at Date of Certified Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products of following manufacturers form basis for design and quality intended.
   1. Ceco Door, Milan, TN.
   2. Curries Company, Mason City, IA.
   3. Door Components, Inc., Fontana, CA.
   4. Mesker Doors, Huntsville, AL.
   5. Republic Doors and Frames, McKenzie, TN.
   6. SteelCraft, an Allegion Brand, Dublin, Ireland.

B. Or equal in accordance with Division 01, General Requirements for Substitutions.

2.02 WELDED FRAMES

A. Type: ANSI A250.8/SDI-100, Level 1 Standard Duty frames, with integral stop and flat trim, double rabbet, profiles as indicated on Drawings, cold rolled steel, Commercial Steel, ASTM A1008, galvanized steel ASTM A653. Minimum: 16 gauge.
   1. Drywall: Provide backbend returns.

B. Anchors: Provide two anchors at head for openings up to 48 inches, three if wider, maximum 30 inches on centers. Provide three at jamb for doors up to 84 inches in height, additional anchors at maximum 30 inches on centers for higher doors.
   1. Provide appropriate type of anchors consistent with type of wall construction for each installation and in conformance with SDI 111 and ANSI 250.11.

C. Floor Attachment: Provide adjustable base anchor with extension for expansion anchor attachment to concrete floor. Extension factory welded. Minimum thickness: 14 gauge.
   1. Wedge Type: KWIK Bolt TZ, 3/8 to 3/4 inch diameter, ICC ESR-1917, by Hilti Inc., Tulsa, OK. Refer to Section 01 40 00.
   2. Monolithic Concrete Slabs: Clip-type anchors, with holes to receive fasteners.

D. Hardware Attachment: Mortise, reinforce, drill and tap at factory to receive specified hardware. Install minimum 10 gauge reinforcing welded to frame for surface mounted hardware, except install 7 gauge reinforcing for hinges. Tap to templates.
   1. Install reinforcing for closers, both sides of frames, on all frames, single and pairs, labeled and non-labeled.
   2. Use 10 Gauge reinforcing for locks, panics, closers, and hold-open arms.

E. Silencers: Make provision for minimum three rubber silencers at strike jamb of all doors except fire-rated doors, and one at head of each leaf of double doors, except fire-rated doors.

2.03 PROTECTIVE COATINGS

A. Interior Frames:
   1. Metallic coating protection not required.
   2. Pretreat and shop prime, air-dried, conforming to ANSI A250.10
   3. Finish paint frames under Section 09 90 00 Painting, colors as indicated on drawings.

B. On surfaces where metallic coating has been damaged or removed during fabrication, frames shall be touched-up with factory-applied primer.

2.04 FABRICATION

A. Fabricate interior welded steel door frames as machine-mitered face-welded unit type. Weld and grind smooth.

B. Where cross mullions or T intersections occur, frames shall be fabricated as butted and face-welded assembly joints. At mullion-to-base intersections extend mullion to floor and face weld. Where butted joints are exposed to weather, seal intersection as specified in Section 07 92 00.

C. Machine mitered faces and butt-joined integral stops permitted with continuous welds.

D. Fabricate frames with hardware reinforcement plates welded in place.

E. Fabricate frames to accept anchors as described in SDI-111 for type of wall construction.

F. Reinforce frames for door closers on both sides of frames.

G. Apply primer to all surfaces of frames, in accordance with requirements of ANSI A250.10. Metallic-coated protected surfaces shall be pretreated prior to application of primer.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install frames in accordance with ANSI A250.11/SDI-105.
   1. Installation of jamb anchors to steel framing: weld to studs.
   2. Install Floor anchors, 1 clip angle per jamb with expansion wedge type anchor.
   3. Check plumb, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.

B. Install insulation behind frames, unless noted otherwise.

C. Coordinate anchor placement with type of wall construction.

D. Paint frames under Section 09 90 00, Painting, colors as indicated on Drawings..

3.02 TOLERANCES

A. Conform to standard of tolerances as required in SDI-117.

END OF SECTION

SECTION 08 13 13

HOLLOW METAL DOORS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Non-rated rolled-steel doors.

B. Related Sections:
   1. Section 06 20 00, Finish Carpentry - Installation of Doors.

1.02 REFERENCE STANDARDS

A. Conform to reference standards by date of issue current on date of Contract Documents.

B. ADA - Americans with Disabilities Act of 1990, as amended.
   1. ADA Standards - ADA Title II Regulations and the 2010 ADA Standards for Accessible Design.

C. SDI - Steel Door Institute.
   1. SDI 100 - Recommended Specifications for Standard Steel Doors and Frames, Latest Edition.
   2. SDI 118 - Basic Fire Door Requirements.
   3. SDI 111 - Standard Details Steel Doors and Frames .
   4. SDI 117 - Manufacturing Tolerances Standard Steel Doors and Frames.

D. ANSI - American National Standards Institute
   1. ANSI A250.4 - Test Procedures and Acceptance Criteria for Physical Endurance for Steel Doors and Hardware Reinforcings.
   2. ANSI A250.5 - Accelerated Physical Endurance Test Procedure for Steel Doors, Frames, and Frame Anchors.
   3. ANSI A250.8/SDI 100 - Recommended Specifications for Standard Steel Doors and Frames.
   4. ANSI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
   5. ANSI A250.11/105 - Recommended Erection Instructions for Steel Frames.

E. ASTM - American Society for Testing and Materials
   1. ASTM A653 - Standard Specification for Sheet Steel, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
   2. ASTM A924 - General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
   3. ASTM A1008 - Standard Specifications for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
   4. ASTM A568 - General Requirements for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled.

F. CBC - 2016 California Building Code
   1. CBC-10 - CBC Chapter 10, Means of Egress
   2. CBC-11 - CBC Chapter 11B, Accessibility to Public Buildings, Public Accommodations, Commercial Facilities and Publicly Funded Housing

G. CRSC - California Referenced Standards Code (CCR Title 24, Part 12)
   1. CRSC-10.2 - Standard 12-10-2 Single Point Latching or Locking Devices
   2. CRSC-10.3 - Standard 12-10-3 Emergency Exit and Panic Hardware

1.03 SUBMITTALS

A. Shop drawings indicating core material, location of cutouts for hardware, reinforcement and finish.

B. Product data.

C. Manufacturer's installation instructions.

1.04 QUALITY ASSURANCE

A. Manufacture doors to conform to SDI standards except where exceeded by this Specification.

B. Comply with ANSI/SDI A250.4 Test Procedure and Acceptance Criteria for - Physical Endurance for Steel Doors and Hardware Reinforcings. Level A, one million cycle swing test performance.

C. ADA-The Americans with Disabilities Act - Title II-Uniform Federal Accessibility Standards.

1.05 DELIVERY, STORAGE AND PROTECTION

A. Deliver and protect doors with manufacturer's shipping safeguards.

B. Storage: Store in dry secure location. Place units on minimum 4-inch high wood blocking. Avoid non-vented plastic or canvas shelters. Provide 1/4-inch wide spaces between stacked doors.

1.06 WARRANTY

A. One-year warranty against defects in materials and workmanship. Warranty to commence at Date of Certified Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products of following manufacturers form the basis for design and quality intended.
   1. Ceco Door, Milan, TN.
   2. Curries Company, Mason City, IA.

3. Door Components, Inc., Fontana, CA.
4. Mesker Doors, Huntsville, AL.
5. Republic Doors and Frames, McKenzie, TN.
6. SteelCraft, an Allegion Brand, Dublin, Ireland.

B. Or equal in accordance with Division 01, General Requirements for Substitutions.

2.02 DOORS

A. Interior Doors: ANSI A250.8/SDI-100, Level 2, Heavy-Duty, Physical Performance Level B, 1-3/4 inches thick, Model 2 Seamless, 18 gauge cold-rolled face sheets, ASTM A1008, seamless continuously welded seam dressed smooth, hollow-steel construction, Close top and bottom with flush end closure, beveled edge profile, sizes as scheduled on drawings, prime coated only. .

B. End Closures: Minimum 18 gauge.

2.03 DOOR CORE

A. Performance Test Procedures Requirements: Conform to ANSI A250.4

B. Core for non-fire-rated doors:
1. Core for interior doors:
a. Rigid polystyrene foam board 1 lb/cu.ft. minimum density. Compressive strength 1750 psf and shear strength minimum 18 psi.
2. Core construction shall conform to requirements of the grade of door specified in accordance with ANSI A250.8/SDI-100, Sections 2.3.2 and 1.4.

2.04 PROTECTIVE COATINGS

A. Interior Doors:
1. Metallic-coating protection not required.
2. Pre-treat and shop prime with modified alkyd, air-dried, conforming to ANSI A250.10.

B. On surfaces where zinc has been damaged or removed during fabrication, doors shall be touched-up with factory-applied primer.

2.05 FABRICATION

A. Fabricate doors from cold-rolled steel conforming to ASTM A1008/A1008M or ASTM A924. Stretcher-leveled standard of flatness for face sheets.

B. Manufacturing tolerances per SDI 117 - Manufacturing Tolerances Standard Steel Doors and Frames.

C. Fabricate doors with cutouts sized for hardware and openings as indicated. Non-handed doors using hinge fillers are not permitted.

D. Reinforce, drill and tap doors to receive mortise hinges, locks, latches, flush bolts and closer. Use reinforcing gauges as listed in Table 4 of ANSI A250.8/SDI-100. Channel or plate reinforcing only.

E. Locate hardware according to Table 5, ANSI A250.8/SDI-100, CBC 11B-404.2.7.

F. Apply primer to all surfaces of doors in accordance with requirements of ANSI A250.10. Metallic-coated surfaces shall be pre-treated prior to application of primer.

G. Hardware Enclosures: Provide enclosures and junction boxes within doors for electrically operated door hardware, interconnected with UL-approved, 1/2-inch-diameter conduit and connectors. Delete subparagraph below if not required.Where indicated for installation of wiring, provide access plates to junction boxes, fabricated from same material and thickness as face sheet and fastened with at least 4 security fasteners spaced not more than 6 inches on centers.

PART 3 - EXECUTION

3.01 INSTALLATION OF HOLLOW METAL DOORS

A. Install doors in accordance with SDI ANSI A250.11/105 and SDI 122 recommendations.

B. Install doors under Section 06 20 00 Finish Carpentry - Installation of Doors.

C. Coordinate installation of glass or louvers where indicated.

3.02 FIELD QUALITY CONTROL

A. Provide manufacturer's installation instructions for each listed assemblies for review by the Inspection Authority.

3.03 ADJUSTING AND CLEANING

A. Adjust for smooth and balanced door movement.

B. Paint doors under Section 09 90 00, colors as indicated on Drawings.

END OF SECTION

SECTION 08 31 13

ACCESS DOORS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Non-rated access doors and frames in walls and ceilings.

B. Related Sections
1. Section 09 90 00, Painting: Field paint finish.
2. Division 21- Fire Suppression.
3. Division 22 - Plumbing.
4. Division 23 - HVAC: Locations and requirements for access doors.
5. Division 26 - Electrical: Locations and requirements for access doors.

1.02 REFERENCE STANDARDS

A. Conform to reference standards by date of issue current on date of Contract Documents.

B. UL - Underwriter's Laboratories.

C. WH - Warnock Hersey.

D. NAAMM - National Association of Architectural Metal Manufacturers

1.03 SUBMITTALS

A. Shop Drawings: Indicate exact positions of all access units.

B. Product data including sizes, types, finishes, scheduled locations and details of adjoining Work.

C. Manufacturer's installation instructions.

1.04 QUALITY ASSURANCE

A. Manufacture fire-rated access doors and frames to conform to UL or WH requirements.

B. Provide labels indicating rating.

C. Clean-Room Access Doors: Airtight/Watertight access doors; Air infiltration less than .01 cfm/sq. ft., ASTM E283. Water penetration; no leakage at 15.05 psf, ASTM E331.

1.05 COORDINATION

A. Locations: Coordinate Work and locations with plumbing, mechanical, electrical and fire sprinkler systems work requiring access units.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Products of following manufacturers form basis for design and quality intended.
   1. Milcor Incorporated; Holland, OH.
   2. The Bilco Company, New Haven, CT.
   3. Karp Associates, Inc.; Maspeth, NY.
   4. JL Industries Incorporated; Bloomington, MN.
   5. Larsen's Manufacturing Company; Minneapolis, MN.
   6. Nystrom Building Products; Minneapolis, MN.
   7. Williams Brothers Corporation of America; Reno, NV.
   8. Elmdor Access Doors, City of Industry, CA.

B. Or equal as approved in accordance with Division 01, General Requirements for Substitutions.

2.02 REGULATORY DESCRIPTION

A. Attic Spaces: an opening not less than 20" x 30" shall be provided to any attic area having a clear height over 30". Clear headroom of not less than 30" shall be provided in the attic space at or above the access opening.

2.03 FABRICATION

A. Fabricate components so as to be straight, square, flat and in same plane where required. Slightly round exposed edges and provide access without burrs, snags and sharp edges. Size: Minimum of 24 inches by 30 inches, unless otherwise specified in this Section or shown/noted on mechanical or electrical Drawings.

B. Weld continuous, fill and grind joints smooth to assure flush and square unit.

C. Hardware: 175 degree steel hinges with removable pin.

D. Number of locks and non-continuous hinges shall be as required to maintain alignment of panel with frame.

E. Provide anchors or make provisions in frame for anchoring to adjacent construction. Provide size, number and location of anchors as required to secure access door in opening.

2.04 ACCESS DOORS, FLUSH PANEL

A. In Gypsum Board framed for walls and ceilings:
   1. Milcor Model DW prime painted with concealed hinges, size 24 inch x 30 inch Acudor Specialty

B. In Suspended Ceilings: Milcor Model AT for acoustical ceilings and ATR for suspended gypsum board ceilings, size; 24 inch x 30 inch.

C. In plaster walls and ceilings: Milcor Model K, size 24" x 30".

D. In cement plaster, masonry concrete: Milcor Model M, prime painted, 14 gauge frame and door panel, size 24 x 30 inches.

E. Door Panel: Form of 14 gauge, for DW and K, thick steel sheet. Reinforce as required to maintain flat surface.

F. Frame: Form of 16 gauge thick steel sheet of depth and configuration to suit material and type of construction where installed. Provide surface mounted units having frame flange at perimeter where installed in concrete, masonry, or existing construction. Weld exposed joints in flange and grind smooth. Provide expanded galvanized metal lath perimeter wings when installed in plastered partitions.

G. Hinge: Concealed spring hinge to allow panel to open 175 degrees. Provide removable hinge pin to allow removal of panel from frame.

H. Lock: Flush, with screwdriver operated steel cam latch.

2.05 FINISH

A. Provide in accordance with NAAMM Metal Finishes Manual on exposed surfaces.

B. Steel Surfaces: Chemically bonded prime coat of baked-on electrostatic powder. Paint finish under Section 09 90 00.

C. Stainless Steel: Type 304, No. 4 finish, for exposed surfaces.

D. Signage: 1" high Helvetica Medium high silk screened text at Fire Department access panels. Colors: Red. Text: Fire Department. Submit text layout for approval.

PART 3 - EXECUTION

3.01 LOCATION

A. Provide wall, ceiling access doors wherever valves, traps, dampers, cleanouts or other control items of mechanical or electrical work are concealed in walls, partitions, or gypsum board or plaster ceiling construction and as indicated on drawings.

B. Use fire-rated doors in fire-rated partitions and ceilings.

C. Use flush panel doors in partitions and ceilings, except lay-in acoustical panel ceilings or upward access acoustical tile ceilings.

3.02 INSPECTION

A. Verify rough openings for door and frame are correctly sized and located.

B. Beginning of installation means acceptance of existing conditions.

3.03 INSTALLATION

A. Install frame plumb and level in ceiling openings.

B. Position to provide convenient access to concealed Work requiring access.

C. Secure rigidly in place in accordance with manufacturer's instructions.

D. Install access doors in openings to have sides vertical in wall installations, and parallel to ceiling grid or side walls when installed in ceiling. Set frames so that edges of frames without flanges will finish flush with surrounding finish surfaces. Set frames with flanges to overlap opening and so that face will be uniformly spaced from finish surface. Set access doors recessed so that face of surrounding materials will finish on same plane when door is installed.

E. Secure frames to adjacent construction using anchors attached to frames or by use of bolts or screws through frame members. Type, size and number of anchoring devices shall be suitable for material surrounding opening, and as required to maintain alignment and resist displacement during normal use of access door and building.

F. Adjust hardware so that door panel will open freely, and when closed door panel will be centered within frame.

G. Paint per Section 09 90 00, Painting. Color and gloss to match adjacent wall.

END OF SECTION

SECTION 087100

DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes commercial door hardware for the following:

1. Swinging doors.
2. Other doors to the extent indicated.

B. Door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Cylinders specified for doors in other sections.

C. Related Sections:

1. Division 08 Section “Hollow Metal Doors and Frames”.
2. Division 08 Section “Flush Wood Doors”.
3. Division 08 Section “Aluminum Entrances and Storefronts”

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. CBC – 2016 California Building Code (CCR Title 24, Part 2 as adopted and amended by DSA OSHPD)
    a. CBC 10 – Chapter 10, Means of Egress
    b. CBC 11B – CBC Chapter 11B, Access to Public Buildings, Public Accomodations, Commercial Facilities and Publicly Funded Housing.
3. NFPA 70 - National Electrical Code.
4. NFPA 80 - Fire Doors and Windows.
5. NFPA 101 - Life Safety Code.
6. NFPA 105 - Installation of Smoke Door Assemblies.
7. State Building Codes, Local Amendments.
8. ADA – Americans with Disabilities Act of 1990, as amended

a. ADA Standards – ADA Title II Regulations and the 2010 ADA Standards for Accessible Design

E. Standards: All hardware specified herein shall comply with the following industry standards:

1. ANSI/BHMA Certified Product Standards - A156 Series
2. UL10C – Positive Pressure Fire Tests of Door Assemblies

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.

3. Content: Include the following information:

a. Type, style, function, size, label, hand, and finish of each door hardware item.
b. Manufacturer of each item.
c. Fastenings and other pertinent information.
d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
e. Explanation of abbreviations, symbols, and codes contained in schedule.
f. Mounting locations for door hardware.
g. Door and frame sizes and materials.
h. Warranty information for each product.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format.

Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

D. Informational Submittals:

1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

E. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals.

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

D. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.

1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.

E. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.

F. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:

1. Function of building, purpose of each area and degree of security required.
2. Plans for existing and future key system expansion.

3. Requirements for key control storage and software.
4. Installation of permanent keys, cylinder cores and software.
5. Address and requirements for delivery of keys.

G. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures

H. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of the hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Electrical component defects and failures within the systems operation.

C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.

D. Special Warranty Periods:

1. Ten years for mortise locks and latches.
2. Five years for exit hardware.
3. Twenty five years for manual surface door closer bodies.

1.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 REGULATORY REQUIREMENTS:

A. Doors/Doorways as part of an accessible route shall comply with CBC Sections 11B-404.

B. Locate latching hardware between 34 inches to 44 inches above the finished floor. Where sliding doors are in the fully open position, operating hardware shall be exposed and usable from both sides, per 2016 California Building Code, Section 11B-404.2.7.
1. Panic hardware: locate between 36 inches to 44 inches above the finished floor.:
2. Force required to activate the operable parts: 5.0 pounds maximum, per 2016 California Building Code Section 11B-309.4.

C. Handles, pull, latches, locks, other operable parts on accessible doors shall comply with CBC Section 11B-309.4 and shall be operable with one hand and shall not require tight grasping,

tight pinching, or twisting of the wrist. Operable parts of such hardware shall be 34" minimum and 44" maximum above finish floor or ground. Where sliding doors are in the fully open positions, operating hardware shall be exposed and usable from both sides. CBC Section 11B-404.2.7

D. The force for pushing or pulling open a door shall be as follows: CBC Section 11B-404.2.9.
   1. Interior hinged doors, sliding or folding doors and exterior hinged doors: 5 pounds (22.2 N) maximum. Required fire doors: the minimum opening force allowable by the DSA authority, not to exceed 15 pounds (67N). These forces do not apply to the force required to retract latchbolts or disengage other devices that hold the door in a closed position.
   2. The force required for activating any operable parts, such as lever hardware ir disengaging other devices shall be 5 pounds (22.2N) maximum to comply with CBC Section 11B-309.4

E. Low-energy powered doors: comply with ANSI/BHMA A156.19. Reference: 2016 California Building Code Section 11B-404.2.9, Exception 2.
   1. Where powered door serves an occupancy of 150 or more, provide back-up battery power or stand-by generator power, capable of supporting a minimum of 150 cycles.
   2. Actuators, vertical bar type: minimum 2-inches wide, 30-inches high, bottom located minimum 5-inches above floor or ground, top located minimum 35-inches above floor or ground. Displays International Symbol of Accessibility, per 2016 California Building Code Section 11B-703.7.
   3. Actuators, plate type: use two at each side of the opening. Minimum 4-inches diameter or 4-inches square. Displays International Symbol of Accessibility, per 2016 California Building Code Section 11B-703.7. Locate centerline of lower plate between 7- and 8-inches above floor or ground, and upper plate between 30- and 44-inches above floor or ground.
   4. Actuator location: conspicuously located, clear and level floor/ground space for forward or parallel approach.

F. Door closing speed shall be as follows: CBC 11B-404.2.8
   1. Closer shall be adjusted so that the required time to move a door from an open position of 90 degrees to a position of 12 degrees from the latch is 5 seconds minimum
   2. Spring hinges shall be adjusted so that the required time to move a door from an open position of 70 degrees to the closed position is 1.5 seconds minimum

G. Smooth surfaces at bottom 10 inches of push sides of doors, facilitating push-open with wheelchair footrests, per 2016 California Building Code Section 11B-404.2.10.
   1. Applied kickplates and armor plates: bevel the left and right edges; free of sharp or abrasive edges.
   2. Tempered glass doors without stiles: bottom rail may be less than 10 inches if top leading edge is tapered 60 degrees minimum.

H. The clear opening width for a door shall be 32 inches minimum. For a swinging door it shall be measured from face of the door and the frame stop, with the door opened to 90 degrees. There shall be no projections into it below 34" and 4" maximum projections into it between 34" and 80" above the finish floor or ground. Door closers and stops shall be permitted to be 78" minimum above the finish floor or ground. 2016 California Building Code Section 11B-404.2.3.

1. Exception**:** doors not requiring full passage through the opening, that is, to spaces less than 24 inches in depth, may have the clear opening width reduced to 20 inches. Example**:** shallow closets.

I. Thresholds**:** floor or landing no more than 0.50 inches below the top of the threshold of the doorway, per 2016 California Building Code Section 11B-404.2.5. Vertical rise no more than 0.25 inches, change in level between 0.25 inches and 0.50 inches**:** beveled to slope no greater than 1**:**2 (50 percent slope). 2016 California Building Code Section 11B-404.2.5

J. Floor stops**:** Do not locate in path of travel. Locate no more than 4 inches from walls, per DSA Policy #99-08 (Access).

K. Pairs of doors with independently-activated hardware both leafs**:** limit swing of right-hand or right-hand-reverse leaf to 90 degrees to protect persons reading wall-mounted tactile signage, per 2016 California Building Code Section 11B-703.4.2.1

L. Door and door hardware encroachment**:** when door is swung fully-open into means-of-egress path, the door may not encroach/project more than 7 inches into the required exit width, with the exception of door release hardware such as lockset levers or panic hardware. These hardware items must be located no less than 34-inches and no more than 48-inches above the floor/ground. 2016 California Building Code, Section 1005.7.1.
   1. In I-2 occupancies, latch release hardware is not permitted to project in the required exit width, regardless of its mounting height, per 2016 California Building Code, Section 1005.7.1 at Exception 1.

M. Hardware (including panic hardware) shall not be provided with "night latch" (NL) function for any accessible doors or gates unless the following conditions are met per DSA interpretation 10-08 DSA/AC (external), revised 4/28/09. Such conditions must be clearly demonstrated and indicated in the specifications:
   1. Such hardware has dogging feature
   2. It is dogged during the time the facility is open
   3. Such dogging operation is performed only by employees as their job function (non-public use)

2.2 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.

B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

C. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

D. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in

writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.3 HANGING DEVICES

A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity, unless otherwise indicated:

a. Two Hinges: For doors with heights up to 60 inches.
b. Three Hinges: For doors with heights 61 to 90 inches.
c. Four Hinges: For doors with heights 91 to 120 inches.
d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

a. Widths up to 3’0”: 4-1/2” standard or heavy weight as specified.
b. Sizes from 3’1” to 4’0”: 5” standard or heavy weight as specified.

3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:

a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.

4. Hinge Options: Comply with the following where indicated in the Hardware Sets or on Drawings:

a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.

5. Acceptable Manufacturers:

a. Bommer Industries (BO).
b. Hager Companies (HA).
c. McKinney Products (MK).

B. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 certified continuous geared hinge. with minimum 0.120-inch thick extruded 6060 T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.

1. Acceptable Manufacturers:

    a. Hager Companies (HA).
    b. McKinney Products (MK).
    c. Pemko Manufacturing (PE).

2.4 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified.

1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
2. Furnish dust proof strikes for bottom bolts.
3. Surface bolts to be minimum 8” in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.

5. Acceptable Manufacturers:

    a. Rockwood Manufacturing (RO).
    b. Trimco (TC).

B. Door Push Plates and Pulls: ANSI/BHMA A156.6 certified door pushes and pulls of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.

1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
4. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.

5. Acceptable Manufacturers:

    a. Hiawatha, Inc. (HI).
    b. Rockwood Manufacturing (RO).
    c. Trimco (TC).

2.5 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.

1. Acceptable Manufacturers:

a. Sargent Manufacturing (SA).

C. Cylinders: Original manufacturer cylinders complying with the following:

1. Mortise Type: Threaded cylinders with rings and cams to suit hardware application.
2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored-Lock Type: Cylinders with tailpieces to suit locks.
4. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
5. Keyway: EXISTING Sargent RE Keyway. Match Facility Standard.

D. Keying System: Each type of lock and cylinders to be factory keyed.

1. Conduct specified "Keying Conference" to define and document keying system instructions and requirements.
2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
3. Existing System: Key locks to Owner's existing system.

E. Key Quantity: Provide the following minimum number of keys:

1. Change Keys per Cylinder: Two (2)
2. Master Keys (per Master Key Level/Group): Five (5).
3. Construction Keys (where required): Ten (10).

F. Construction Keying: Provide construction master keyed cylinders.

G. Key Registration List (Bitting List):

1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
2. Provide transcript list in writing or electronic file as directed by the Owner.

H. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.

1. Acceptable Manufacturers:

a. Lund Equipment (LU).
b. MMF Industries (MM).
c. Telkee (TK).

2.6 MECHANICAL LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 certified. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.

1. Acceptable Manufacturers:

a. Sargent Manufacturing (SA) – 8200 Series.

B. Narrow Stile Interconnected Locksets:

1. Interconnected locksets designed with a mortise case which contains both a latchbolt and deadbolt and allows simultaneous retraction of both the latchbolt and deadbolt with a single motion turning of the lever handle.

2. Locksets to be non-handed and available with a 1 1/8” or 1 1/2” standard backset.

3. Latchbolt and deadbolt shall be fabricated of wrought brass and bronze with a minimum 3/4" latchbolt throw and 1” deadbolt throw.

4. Acceptable Manufacturers:

a. Adams Rite (AD) – 2190/2290 Series.

2.7 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.8 ELECTRIC STRIKES

A. Standard Electric Strikes: Heavy duty, cylindrical and mortise lock electric strikes conforming to ANSI/BHMA A156.31, Grade 1, UL listed for both Burglary Resistance and for use on fire rated door assemblies. Stainless steel construction with dual interlocking plunger design tested to exceed 3000 lbs. of static strength and 350 ft-lbs. of dynamic strength. Strikes tested for a minimum 1 million operating cycles. Provide strikes with 12 or 24 VDC capability and supplied standard as fail-secure unless otherwise specified. Option available for latchbolt and latchbolt strike monitoring indicating both the position of the latchbolt and locked condition of the strike.

1. Acceptable Manufacturers:

    a. HES (HS).

2.9 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.

2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer’s catalog and template book for specific requirements.

3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.

4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.

5. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.

    a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
    b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.

6. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.

7. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2” wide stiles.

8. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.

9. Rail Sizing: Provide exit device rails factory sized for proper door width application.

10. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.

1. Acceptable Manufacturers:

a. Sargent Manufacturing (SA) - 80 Series.

C. Tube Steel Removable Mullions: ANSI/BHMA A156.3 removable steel mullions with malleable-iron top and bottom retainers and a primed paint finish.

1. Provide keyed removable feature where specified in the Hardware Sets.

2. Provide stabilizers and mounting brackets as required.

3. Provide electrical quick connection wiring options as specified in the hardware sets.

4. Acceptable Manufacturers:

a. Sargent Manufacturing (SA) - 980S Series.

2.10 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.

2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.

3. Cycle Testing: Provide closers which have surpassed 15 million cycles in a test witnessed and verified by UL.

4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1.

5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.

6. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.

7. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Commercial Duty): ANSI/BHMA 156.4, Grade 1 certified surface mounted, institutional grade door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck, closing sweep, and latch speed control valves. Provide non-handed units standard.

1. Acceptable Manufacturers:

a. Norton Door Controls (NO) - 8500 Series.
b. Sargent Manufacturing (SA) - 1431 Series.

2.11 SURFACE MOUNTED CLOSER HOLDERS

A. Electromagnetic Door Holders: Certified ANSI A156.15 electromagnetic door holder/releases with a minimum 20 to 40 pounds holding power and single coil construction able to accommodate.12VDC, 24VAC, 24VDC and 120VAC. Coils to be independently wound, employing an integral fuse and armatures to include a positive release button.

1. Acceptable Manufacturers:

a. Rixson (RF) - 980/990 Series.

2.12 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.

Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1” LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.

2. Where plates are applied to fire rated doors with the top of the plate more than 16" above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer's catalog and template book for specific requirements for size and applications.

3. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:

    a. Stainless Steel: 300 grade, 050-inch thick.

4. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.

5. Acceptable Manufacturers:

    a. Hager Companies (HA).
    b. Rockwood Manufacturing (RO).
    c. Trimco (TC).

2.13 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Acceptable Manufacturers:

    a. Hager Companies (HA).
    b. Rockwood Manufacturing (RO).
    c. Trimco (TC).

C. Overhead Door Stops and Holders: ANSI/BHMA A156.6, Grade 1 certified overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.

1. Acceptable Manufacturers:

    a. Rixson Door Controls (RF).
    b. Rockwood Manufacturing (RO).

2.14 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.

1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.

1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Acceptable Manufacturers:

1. Pemko Manufacturing (PE).
2. Reese Enterprises, Inc. (RE).
3. Zero (ZE).

2.15 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.16 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware

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

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.

1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9

Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with

corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

B. Manufacturer's Abbreviations:

1. MK - McKinney
2. RO - Rockwood
4. SA - Sargent
5. AD - Adams Rite
6. HS - HES
7. RF - Rixson
8. NO - Norton
8. NO - Norton

Hardware Sets

Set: 1.0

Doors: X12

3	Hinge	TA714 (NRP)	US26D	MK
1	Storeroom Lock	8204 LNL	626	SA
1	Stop	351 CPSH TB	626	SA
1	Closer	351-H TB	626	SA
1	Mop Plate	K1050 6" BEV CSK	US32D	RO
1	Kick Plate	K1050 10" BEV CSK	US32D	RO
3	Silencer	608-RKW	GR	RO

END OF SECTION 087100

SECTION 09 01 90

REPAIRING AND PAINTING OF EXISTING PAINTED SURFACES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Supply and apply interior and exterior painting to existing surfaces as indicated in drawings and specified herein.

B. Preparing and repairing existing surfaces.

C. Following items shall not be painted:
   1. Prefinished wall, ceiling and floor coverings.
   2. Items with factory-applied final finish, unless otherwise noted on drawings.
   3. Glass, plastic laminate, ceramic tile, anodized aluminum.
   4. Surfaces specifically scheduled or noted on the Drawings not be painted. Fire-Rated Labels on doors or frames.

1.02 SUBMITTALS

A. Complete list of all materials to be furnished stating supplier and distributor's names with product recommendations.

B. Manufacturer's standard color samples for each type of paint specified. Once colors have been selected, submit four (4) samples of each color selected for each type of paint, on standard 8-1/2 by 11 inches spray-out panel for the required sheen, color, and texture.

C. On wood surfaces, provide four (4) 4 by 8 inches samples for clear wood finish.

D. On actual wall surfaces and other building components, duplicate painted finishes of acceptable samples.

E. Certification of materials.

1.03 QUALITY ASSURANCE

A. Certification of Materials: With every delivery of paint materials, manufacturer shall certify that materials comply with requirements of this Section.

B. Paint materials shall comply with applicable requirements of the Food and Drug Administration's (FDA) Lead Law and the California Air Resources Board (CARB), and the Environmental Protection Agency (EPA).

C. Product Manufacturer: Company specializing in manufacturing quality paints and finishes products with three years experience.

D. Applicator: Company specializing in commercial painting and finishing with three years documented experience. Experienced skilled craftsmen shall do all work.

E. Employ coats and undercoats for all types of finishes in strict accordance with the recommendations of the paint manufacturer. All finishes shall be applied evenly and be free from runs, sags, crawls, or other defects.

F. Provide primers and undercoat paint produced by the same manufacturer as the finish coat.

G. Field Samples: On actual wall surfaces and other interior components, duplicate coating finishes of approved samples. Provide full-coat finish samples on at least 100 sq. ft. of surface until required sheen, color, pattern and texture are obtained; simulate finished lighting conditions for acceptance of in-place work by the Architect. Finish acceptance of coating will be from approved samples.

1.04 DELIVERY, STORAGE AND HANDLING

A. Materials shall be delivered to project site in original unbroken containers bearing manufacturer's name, brand number and batch number.

B. Open and mix ingredients on premises in presence of the Inspector. Immediately remove rejected materials from premises.

C. Storage and Mixing of Materials: Store materials and mix only in spaces designated for purpose by the Inspector. Keep such spaces clean and take necessary precautions to prevent fire. Hang out oily rags and singly in the open air. Stack paints containers so that manufacturer's labels are clearly displayed.

D. Take all necessary precautions to secure all painting equipment and painting stock after the completion of work each day to prevent damages/vandalism due to accessibility of paints to non-authorized personnel.

E. Extra Stock:
1. Label each container with color, texture and room locations in addition to the manufacturer's label.

1.05 ENVIRONMENTAL CONDITIONS

A. Provide continuous ventilation and heating facilities to maintain surface and ambient temperatures above 45 degrees F for 24 hours before, during and 48 hours after application of finishes, unless permitted otherwise by manufacturer's instructions.

B. Do not apply exterior coatings during rain, or when relative humidity is above 50 percent, unless permitted otherwise by manufacturer's instructions.

C. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

D. Minimum Application Temperature for Varnish and transparent Finishes: 65 degrees F for interior or exterior, unless permitted otherwise by manufacturer's instructions.

E. Provide lighting level sufficient to conduct painting operations.

1.06 WARRANTY

A. Contractor’s workmanship and manufacturer’s material warranty shall be for two (2) years and in accordance with requirements of the Contract Documents, except that warranty shall be furnished jointly by Contractor and material manufacturer. All work shall follow the requirements of this section and the recommendations of the manufacturer, including but not limited to:
   1. Inspect all substrates before proceeding with surface preparation and provide written notification to the Architect that all surfaces are acceptable or indicate any inconsistencies with their condition.
   2. In conjunction with the material manufacturer conduct site reviews of the surface preparation prior to commencing application of coatings and monitor the application of materials by issuing a written report.

PART 2 - PRODUCTS

2.01 PAINT MATERIALS

A. Specified in Section 09 90 00 Painting.

PART 3 - EXECUTION

3.01 PREPARATION OF EXISTING PAINTED SURFACES - PAINT

A. Examine surfaces to receive paint finish. Surfaces which are not properly prepared and cleaned or which are not in condition to receive the finish specified, shall be corrected before paint is applied. No painting shall be done on existing painted surfaces until the Architect and Inspector approve surfaces.

B. Remove electrical plates, hardware, light fixture trim and fittings prior to preparing surfaces for finishing.

C. Ascertain that new paint system is compatible with existing coatings, gloss and high-gloss, and oil based paint systems to insure proper adhesion. Determination of coatings compatibility may be accomplished through examination of Owner’s records, laboratory analysis, or field testing. For field test, apply a “test patch” of 3 square feet and allow to dry for a week before testing adhesion in accordance with ASTM D3359.

D. Existing interior painted surfaces indicated to be painted, shall be prepared as follows:

1. Clean all interior surfaces in accordance with this Section. Remove surface contaminants without damaging the substrates or adjacent areas such as oils, grease, loose paint, cracking, blistering, peeling or flaking paint, dirt, foreign matter, rust, mold, mildew, and all other surface contaminants that will interfere with adhesion of subsequent coats, by methods referenced in ASTM D4258. Clean all surfaces, corners, contours, and interstices. Let dry thoroughly, LIGHT SAND all surfaces to receive new finishes. Repair existing minor defects, prime bare areas with specified primer.
    a. Detergent Cleaning: Wash surfaces by hand using clean rags, sponges, and bristle brushes. Scrub surface with detergent solution and bristle brush until soil is thoroughly dislodged and can be removed by rinsing. Use small brushes to remove soil from joints and crevices. Dip brush in solution often to ensure that adequate fresh detergent is used and that surface remains wet. Rinse with water applied by clean rags or sponges.
    b. Solvent Cleaning: Use solvent cleaning to remove oil, grease, smoke, tar, and asphalt from painted or unpainted surfaces before other preparation work. Wipe surfaces with solvent using clean rags and sponges. If necessary, spot-solvent cleaning may be employed just prior to commencement of paint application, provided enough time is allowed for complete evaporation. Use clean solvent and clean rags for the final wash to ensure that all foreign materials have been removed. Do not use solvents, including primer thinner and turpentine, that leave residue.
    c. Mildew: Clean off existing mildew, algae, moss, plant material, loose paint, grease, dirt, and other debris by scrubbing with bristle brush or sponge and detergent solution. Scrub mildewed areas with mildewcide. Rinse with water applied by clean rags or sponges.
2. Gypsum Board: remove contamination from surfaces and prime to show defects, if any. Prepare surfaces to align and to match adjacent surfaces. Feather edges into the existing adjacent surface. Paint after defects have been remedied. Repair cracks, holes, gouges and damaged spots larger than 1/2", per Section 09 29 00-Gypsum Board.
3. Work by experienced skilled craftsmen only. Surface preparation shall be in accordance with standards of the Painting and Decorating Contractors of America. Apply finishes evenly and be free from runs, sags, crawls, or other defects.
4. Glossy surfaces of existing paint films must be cleaned and dulled before repainting. Wash thoroughly as specified and dull by sanding. Degloss all glossy and previously enameled surfaces to provide a roughened surface or “tooth” for good adhesion of subsequent coats.
5. Apply separation coats to prevent non-compatible coatings from having contact only as approved by the Owner and the coating manufacturer.
6. Surfaces shall then be considered as new work. Paint as scheduled.

E. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

F. Before any work is started, cover all floors completely with canvas or a non-staining film (red crepe paper or plastic) cover and protect all surfaces and any unpainted surfaces.

G. Ceilings: Air blow, broom, rag and dust all surfaces to remove as much dust and dirt as possible. Hand scrape and machine wire tool to remove all loose and peeling paint to a tight edge.

H. Interior Walls: Prepare all walls after ceilings are completed.

I. Door and Window Frames, Side Lites, jambs and headers: clean and light sand smooth.

J. Except where scheduled for complete painting, apply finish coats over plane surface to nearest break in plane, such as corner, reveal, or frame.

K. In existing rooms and areas where alterations occur, clean existing stained and natural finished wood, retouch abraded surfaces apply entire surfaces one coat of polyurethane varnish (PV).

L. Refinish areas as specified for new work to match adjoining work unless specified or scheduled otherwise.

M. Coat knots and pitch streaks that show through old finish with knot sealer before refinishing.

N. Measure moisture content of surfaces using an electronic moisture meter. Do not apply, finishes, unless moisture content surfaces are below the following maximums:
1. Moisture content for masonry and stucco must not exceed 17%.
2. Moisture content for exterior wood must not exceed 12%.
3. Moisture content for interior wood must not exceed 8%.

3.02 PROTECTION

A. Protect work of other trades or existing adjacent surfaces or areas, whether to be coated or not, against damage from coating. Correct damage by cleaning, repairing, replacing and recoating as acceptable to the Inspector. Leave in an undamaged condition.

B. Provide sufficient drop cloths, shields, and protective equipment to prevent spray or droppings from fouling surfaces, furniture, equipment, cabinets, etc. in all areas required to complete the work.

C. Protect prefinished surfaces, lawns, shrubbery and adjacent surfaces against paint and damage.

D. Protect surfaces, equipment and fixtures from damage resulting from use of fixed, movable and hanging scaffolding, planking and staging.

E. Place all waste materials, cloths, and material that may constitute a fire hazard in closed metal containers and remove daily from the site.

F. Remove electrical plates, surface hardware, fittings and fastenings, prior to painting operations. These items are to be carefully inventoried and marked, stored, cleaned, and replaced at the completion or work in each area. Do not use solvent to clean hardware or items that may remove permanent lacquer finish.

G. Provide "WET PAINT" signs, barricades and other devices required to protect newly coated finishes. Remove temporary protective wrappings provided by others for protection of their work, after completion of coating operations.

H. Take all necessary precautions to secure all painting equipment and painting stock after the completion of work each day to prevent damages/vandalism due to accessibility of paints to non-authorized personnel.

3.03 CLEANING, TOUCH-UP AND REFINISHING

A. As work proceeds and upon completion, promptly remove paint where spilled, splashed, or spattered.

B. During progress of work keep premises free from any unnecessary accumulation of tools, equipment, surplus materials, and debris.

C. Upon completion of work remove all rubbish, paint cans and accumulated materials resulting from work in each space or room. All areas shall be left in a clean, orderly condition to the satisfaction of the Owner.

D. Upon completion of painting, clean glass and paint spattered surfaces. Remove spattered paint by washing, scrapping or other professional methods using care not to scratch or damage adjacent finished surfaces.

3.04 SCHEDULE: INTERIOR SURFACES

A. Refer to Section 09 90 00 Painting.

END OF SECTION

SECTION 09 22 26

DRYWALL SUSPENSION SYSTEM

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Drywall Suspension System with flat main tees, Heavy Duty.

B. Splices and accessories.

C. Suspension Accent Trims.

D. Related Sections:
   1. Section 09 29 00, Gypsum Board.
   2. Section 09 90 00, Painting.

1.02 REFERENCE STANDARDS

A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.

B. ASTM C635 - Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings

C. ASTM C636 - Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.

D. ASTM E84 - Surface Burning Characteristics of Building Materials.

E. Chapter 19A, California Building Code.

F. Chapter 23, California Building Code.

G. CBC - California Building Code -2016.

H. ICC Evaluation Services Inc., ES Report ESR-1289.

1.03 SYSTEM DESCRIPTION

A. Drywall suspension system consisting of straight main tees along with straight furring cross channels or cross tees, that join together to support screw attached gypsum panels and independently supported light fixtures, and air diffusers, where applicable. Where applicable, installed systems must conform to Underwriters Laboratories, Inc. (UL) Fire Resistance Design No. and other applicable codes.

1.04 SUBMITTALS

A. Samples: Submit actual samples and technical data for suspension system main tees and cross tees for review.

B. Shop Drawings:
   1. Reflected ceiling plans: Submit ceiling suspension system layout indicating dimensions, lighting fixture locations, and related mechanical components.
   2. Assembly drawings: Indicate installation details, accessory attachments and installation of related lighting fixtures and related mechanical system components.

C. Manufacturer's Data:
   1. System details: Submit manufacturer's catalogue cuts or standard drawing showing details of system with project conditions clearly identified and manufacturer's recommended installation instructions.

D. Materials: Provide 5 percent of amount of main tees and cross tees installed.

1.05 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacture of ceiling suspension system with five years minimum experience.

B. Installer: Company with five years minimum experience.

1.06 DELIVERY, STORAGE AND HANDLING

A. Delivery of materials: Deliver materials in original, unopened packages clearly labeled with manufacturer's name, item description, part number, type and class, as applicable.

B. Storage: Store in manner that will prevent warpage, scratches, or damage of any kind. Prevent interference to/by other trades and any other adverse job conditions due to storage locations or methods.

C. Handling: Handle in such manner to ensure against racking, distortion, or physical damage of any kind.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products of following manufacturers form basis for design and quality intended.
   1. Armstrong World Industries, Lancaster, CA. Product: Drywall Grid System.
   2. USG Interiors Inc., Chicago, IL; Product: Drywall Suspension System.

B. Or equal as approved in accordance with Division 01, General Requirements for substitutions.

2.02 SUSPENSION SYSTEM MATERIALS

A. Gypsum Board Panels; As specified in Section 09 29 00
   1. USG Sheetrock Brand Gypsum (Regular, Firecode, Firecode C) or equal.

a. Gypsum Board Thickness (Wet): 1/4" for 2 feet minimum radius 3/8", 3/8" for 3 feet minimum radius, 1/2" for 4 feet minimum radius. 28 feet radius and larger use 5/8".

B. Drywall Suspension Systems: ASTM C635, ASTM C636. ASTM C645 Standard Specification for Rigid Furring Channels for Screw Applications of Gypsum Board.
1. Main Tees: Armstrong # HD8901 Heavy Duty classification 1-11/16 inches high by 144 inches long, integral reversible splice, double-web construction steel (minimum .0179") with knurled face 1-1/2 inches face minimum, galvanized G40.
2. Cross Members: double-web construction, knurled face.
3. Cross Tees: Armstrong #8341 1-1/2 high by 48 long with 1-1/2 inches wide face. Cross tee ends to provide positive locking, staked-on type.
4. Furring (Hat) Channel: Armstrong # HD8940.
5. Accessory Cross Tees: As required for applications, cross tees must have knurled faces. Cross tees have quick release cross tee ends to provide positive locking and removability without the need for tools.
6. Wall moldings: galvanized steel, single web with knurled face.
   a. Angle Molding: 1-1/4" by 1-1/4" by 120 inches long wall molding.
   b. Channel Molding: 1-9/16" high by 1-1/4" long leg by 3/4" short leg.
7. Suspension Accent Trim: Armstrong Axiom Classic extruded aluminum, painted, sizes: 2-1/4". Provide attachment clips, corner pieces and splices. Refer to drawings for location and sizes and curve requirements.

C. Accessories
1. Transition Clips, manufacturer's standard for model specified.
2. Splice Clips, manufacturer's standard for model specified.
3. Wall Attachment Clip Curved Tees or manufacturer's standard.
4. Splice Plate, Radius Clips: Armstrong RC2, factory Cut Ends or manufacturer's standard. Screws: #6 x 1/2" long, 4 each clip.

D. Corner Bead: Minimum #26 gauge, zinc alloy with or without paper flanges or plastic bead.

E. Casing Bead: Minimum #24 gauge, zinc alloy or plastic with expanded flanges.

F. Control Joints: Minimum #26 gauge, zinc alloy, extruded aluminum or plastic with expanded flanges.

G. Gypsum Panel fasteners: ASTM C1002, No. 6 Type-S, HiLo bugle head, self-drilling, self-tapping steel screws.

H. Hanger Wire: No. 9 gauge galvanized, annealed steel wire.

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify that existing conditions are ready to receive work.

B. Verify that layout of hangers will not interfere with other work.

C. Verify dimensions prior to installation.

D. Beginning of installation means acceptance of existing conditions.

3.02 INSTALLATION

A. Refer to drawings for vaults, undulating, convex, concave ceiling forms. Conform with manufacturer's curved suspension accessories and radii dimension limitations.

B. Install system in accordance with ASTM C636, ASTM E580, Section 2501 California Building Code and DSA IR 25-3.13, and as supplemented in this Section.

C. Install in accordance with manufacturer's recommended procedures and with approved shop drawings, and locate ceiling in accordance with main tee dimensions relative to elevations

D. Ceiling assemblies in exitways shall be installed with a main runner, cross runner or ledger surrounding all sides of each panel and each light fixture or grill. Splices and intersections of such runners shall be attached with through-connectors such as pop rivets screws, pins, plates with bent tabs or by other approved connectors at wall slip joint and wall ledger, provide a main runner parallel to wall, suspended with 9 gauge hangar wires spaced 4 ft on centers and one pair of parallel bracing wires spaced 12 feet on centers. Such main runner shall be locked to each intersecting, perpendicular grid member by an approved through-connection splice.

E. Ceilings shall not support material or building components other than grilles or light fixtures except as herein provided. Ductwork, plumbing and like work shall have its own support system and shall not utilize the ceiling system or suspension wires.

F. 9 gauge hanger wires 4' on center shall be used to support a maximum ceiling area of 16 square feet. Spaced main runner at 4' on center. 12 gauge wires permitted at tributary areas less than 9 square feet. Splices will not be permitted in any hanger wires.

G. Cross Tee: spaced at 24" on center, maximum.

H. Provide 9 gauge minimum hanger wires at the ends of main and cross runners within 8 inch from the support or within 1/4 of the length of the end tee, whichever is least, for the perimeter of the ceiling area.

I. Provide trapeze or other supplementary support members at obstructions to main hanger spacing. Provide additional hangers, struts or braces as required at ceiling breaks, soffits or discontinuous areas. Hanger wires that are more than 1 in 6 out of plumb shall have counter-sloping wires.

J. Ceiling grid members shall be attached to not more than 2 adjacent walls. Ceiling grid members shall be at least 1/2 inch free of other walls. If walls run diagonally to ceiling grid system runners, one end of main and cross runners shall be free and a minimum of 1/2 inch clear of wall.

K. At the perimeter of the ceiling area where main or cross runners are not connected to the adjacent wall, provide interconnection between the runners at the free end to prevent lateral spreading. A metal strut or a 16 gauge wire with a positive mechanical connection to the runner may be used. Where the perpendicular distance from the wall to the first parallel runner is 12 inches or less, this interlock is not required.

L. Provide sets of four 12 gauge minimum splayed bracing wires oriented 90 degrees from each other at a spacing of 12 ft by 8 ft. Install vertical compression strut at each set of bracing wires per one of the following, unless noted otherwise on drawings.
   1. Stud Compression Struts: unless otherwise note on drawings strut shall be: 20 gauge 4 inch stud. Attach to main runners within 2 inch of cross runner with 2-# 12 self-drilling self-tapping (SDST) screws and to structure with 2-#12 by 2 inch screws at wood or 3/16 inch diameter anchor at concrete/steel. Compression strut shall not replace hanger wire.
   2. Rigid Conduit Compression Struts: Install a 12 GA. vertical hanger wire and tie to main runner no more than 2 inches from splay intersection. Run the hanger wire inside a sleeved 1/2-inch rigid electric conduit and 3/4 inch rigid electric conduit, extend tubes tight to structure above and ceiling grid below. To secure sleeved tubes drill a 5/32-inch hole and install through a 1/8-inch bolt with locking nut, tubes shall lap one another min. 4 inches in fully extended position. Cut a slot in the 3/4-inch conduit to straddle the main runner and secure with 2 #12 self-tapping sheet metal screws.

M. Provide bracing wires at locations not more than 1/2 the spacings specified herein from each perimeter wall and at the edge of vertical ceiling offsets.

N. The slope of bracing wires shall not exceed 45 degrees from the plane of the ceiling and shall be taut without causing the ceiling to lift. Splices in bracing wires are not permitted. Powder actuated fasteners are not permitted for the attachment of splay wires. Conform to Section 01 40 00 for testing requirements for fasteners.

O. Fasten hanger wires with not less than 3 tight turns. Fasten bracing wires with 4 tight turns. Make all tight turns within a distance of 1-1/2 inches. Hanger or bracing wire anchors to the structure shall be installed in such a manner that the direction of the wire aligns as closely as possible with the direction of the forces acting on the wire. Wire turns made by machine where both strands have been deformed or bent in wrapping can waive the 1-1/2 inch requirement, but the number of turns shall be maintained and shall be as tight as possible.

P. Separate all ceiling hanging and bracing wires at least 6 inches from unbraced ducts, pipes or conduit. Attach lightweight items, such as single electrical conduit not exceeding 3/4 inch nominal diameter to hanger wires using approved connectors.

Q. Attach light fixtures to the ceiling grid runners to resist a horizontal force equal to the weight of the fixtures.

R. Flush or recessed light fixtures and air terminals or services weighing less than 56 pounds may be supported directly on the runners. Install a minimum of two 12 gauge slack safety wires attached to the fixture at diagonal corners and anchored to the structure above. 4 feet by 4 feet light fixtures must have slack safety wires at each corner.

S. Flush or recessed light fixtures and air terminals or services weighing 56 pounds or more shall be independently supported by not less than 4 taut 12 gauge wires each attached to the fixture and to the structure above.
   1. The 4 taut 12 gauge wires including their attachment to the structure above shall be capable of supporting 4 times the weight of the unit.

T. Support surface mounted light fixtures by at least two positive devices which surround the ceiling runner and which are each supported from the structure above by a 12 gauge wire. Spring clips or clamps that connect only to the runner are not acceptable. Provide additional supports when light fixtures are 8 feet or longer.

U. Support pendant mounted light fixtures directly from the structure above with hanger wires or cables passing through each pendant hanger and capable of supporting 4 times the weight of the fixture.

V. Partitions: If non-bearing partitions that extend to and terminate at a suspended ceiling are supported laterally by opposing bracing wires spaced a maximum of 8 ft oc along the top edge of the partition or by other equivalent means, they shall be considered as not adding to the lateral load required to be resisted by the ceiling system.

W. Do not eccentrically load system or produce rotation of runners.

X. Install edge angle at intersection of ceiling and vertical surfaces using longest practical lengths. Miter corners. Provide edge angles at junctions with other interruptions. Where curved obstructions occur, provide preformed closers to match edge molding.

Y. Form expansion joints as indicated on drawings.

Z. Gypsum Panel Installation
   1. At curved gypsum board installation: apply water to the side of the panel that will be in compression. Apply water uniformly over the surface of the boards. Stack moistened boards on flat surface and cover with plastic sheeting. Allow water to soak into panels for minimum 1hour before application. Allow installed panels to dry 24 hours before finishing.
   2. At flat ceiling gypsum board installation: Position ends and edges of gypsum panels at framing members. Extend ceiling board to corners and make firm contact with wall angle, channel or top plate. To minimize end joints, use panels of maximum practical lengths. Fit ends and edges closely, but not forced together.
   3. Cut ends, edges, scribe or make cutouts within field of panels in workmanlike manner. Cut gypsum board to size using knife and straight edge.

4. Attach Gypsum Panels to suspension system per manufacturer's DSA-approved system with conventional gypsum panel fasteners (No. 6 Type S HiLo bugle head, self-drilling, self-tapping steel screws, ASTM C1002) spaced 8 inches on centers at periphery of gypsum panels and located 3/8 inch from panel edges and spaced 12 inches on centers in field. Drive fasteners in field of panels first, working toward ends and edges. Hold panels in firm contact with framing while driving fasteners. Drive fastener heads slightly below surface of gypsum panels in uniform dimple without breaking face paper.
5. Install trim at internal and external angles formed by intersection of panel surfaces or other dissimilar materials.
    a. Apply corner bead to vertical or horizontal external corners in accordance with manufacturer's directions.
    b. Spacing of drywall grid is designed to support only the dead load. Heavy concentrated loads should be independently supported.
    c. Lighting fixtures or troffers, air vents and other equipment should be separately supported from structure; gypsum panels will not support these items.
    d. Do not install insulation on top of gypsum ceiling panels
6. Provide separation in suspension system at expansion joints as shown on drawings and carry joint through gypsum panels. Expansion joints are installed between two main tees to separate the suspension system and allow for movement in large ceiling areas.

3.03 FINISHING

A. Touch up all minor scratches and spots.

B. Painting: Finish Suspended gypsum ceiling per Level 5 specified in Section 09 29 00. Paint per Section 09 90 00.

C. Removal of debris: Remove all debris resulting from work of this section.

3.04 TOLERANCES

A. Flat Ceilings: Variation from Flat and Level Surface: 1/8 inch in 10 feet.

END OF SECTION

SECTION 09 29 00

GYPSUM BOARD

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Gypsum Board Panels.

B. Vertical wall gypsum board application.

C. Taped and sanded joint treatment.

D. Metal channel ceiling framing and horizontal ceiling gypsum board application.

E. Related Sections
1. Section 01 35 42, CALGreen Requirements.
2. Section 09 90 00, Painting

1.02 REFERENCE STANDARDS

A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.

B. American Society for Testing and Materials (ASTM)
1. ASTM C475 - Joint Compound and Joint Tape for Finishing Gypsum Board.
2. ASTM C645 - Specification for Nonstructural Steel Framing Members.
3. ASTM C754 - Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
4. ASTM C840 - Application and Finishing of Gypsum Board.
5. ASTM C954 - Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. to 0.112 in. in thickness.
6. ASTM C1002 - Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases.
7. ASTM C1396 - Specification for Gypsum Board.

C. Underwriters Laboratories, Inc. (UL)
1. UL Directory - Fire Resistance Directory, Volume 1, Latest Edition.

D. Gypsum Association (GA)
1. GA-201 - Gypsum Board for Walls and Ceilings
2. GA-214 - Levels of Gypsum Board Finish
3. GA-216 - Application and Finishing of Gypsum Board
4. GA-600 - Fire Resistance Design Manual
5. GA-226 - Gypsum Board installation on Curved Walls.

E. 2016 California Building Code (CBC)
1. CBC-7 - Chapter 7, Fire Resistant Materials and Construction

2. CBC-19A - Chapter 19A, Concrete (for DSA)
3. CBC-25 - Chapter 25, Gypsum Board and Plaster.

F. California Green Building Standards Code, CALGreen - 2016.

G. Division of the State Architect, Interpretation of Regulations (DSA-IR)
1. DSA-IR 25-3.13, Drywall Ceiling Suspension Conventional Construction-One Layer.
2. DSA-IR 25-2.13, Metal Suspension Systems for Lay in Panel Ceilings.

1.03 SUBMITTALS

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

B. Shop Drawings: Show locations, fabrication, and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other units of Work.

C. Samples: For following products:
1. Trim Accessories: Full-size sample in 12-inch-long length for each trim accessory indicated.
2. Textured Finishes: Manufacturer's standard size for each textured finish indicated and on same backing indicated for Work.

D. CALGreen Submittals:
1. Product Data Sheets and Declaration Statements showing compliance with CALGreen Code, per paragraph 1.04.B this Section.

1.04 QUALITY ASSURANCE

A. Applicator: Company specializing in gypsum board systems work with three years' experience.

B. California Green Building Standards Code, CALGreen - 2016.
1. Adhesives, sealants, primers and caulks shall comply with air quality management district rules where applicable, or SCAQMD Rule 1168 VOC limits, per CALGreen Tables 5.504.4.1 and 5.504.4.2.
2. Paints and Coatings shall comply with VOC limits in Table 1 of the ARB, per CALGreen Table 5.504.4.3
3. Composite wood products (plywood, particle board, medium density fiberboard) shall comply with Formaldehyde limits per CALGreen Table 5.504.4.5.
4. Recycled Content per CALGreen Section A5.405.4.

1.05 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.

C. Steel Framing and related accessories shall be stored and handled in accordance with AISI Code of Standard Practice.

1.06 WARRANTY

A. Provide manufacturer's warranty, 3 years against manufacturing defects.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products of following manufacturer form basis for design and quality intended:
   1. United States Gypsum Corporation (USG), Chicago, IL.

B. Subject to compliance with requirements, other acceptable manufacturers include the following:
   1. Georgia-Pacific, Atlanta, GA.
   2. National Gypsum Co./Gold Bond Building Products, Charlotte, NC.
   3. Pabco Gypsum, Rancho Cordova, CA.
   4. CertainTeed Corporation, Valley Forge, PA.
   5. Temple-Inland Forest Products, Diboll, TX.

C. Or equal as approved in accordance with Division 01, General Requirements for Substitutions.

2.02 BOARD MATERIALS

A. Regular Gypsum Board: ASTM C1396; 5/8 inch thick, maximum permissible length; ends square cut, tapered round edges, USG SHEETROCK BRAND TAPERED GYPSUM PANELS SW.

B. Fire-rated Gypsum Board, 1HR: ASTM C1396; Type X, fire resistive type, 5/8 inch thick, maximum permissible length; ends square cut, tapered round edges, USG SHEETROCK BRAND FIRECODE, or equal.

2.03 MATERIALS

A. Furring Channels: 25 gauge galvanized steel, 7/8 inch deep by 2-9/16 inch wide hat channels, 275 pounds per 1,000 feet weight, FHC-25 and CEMCO METAL FURRING CHANNEL CLIPS. Z Type, where required: CEMCO Z-FURRING CHANNEL, 1", 1-1/2", 2" and 3" depths.
   1. Dietrich UltraSteel Framing, 25 gauge or equal.

B. Angles: 1-3/8 inch by 7/8 inch, 24 gauge, Dietrich Metal Framing, CEMCO GALVANIZED METAL ANGLES or equal.

C. Runner Channels: Minimum weights, sizes and maximum spans conform to reference standard listed in Table 2506.2 California Building Code, 1-1/2", 1.12 lbs/foot, hot-rolled channels as defined therein.

D. Hanger Wire: 8 gauge for 16 square feet maximum, galvanized annealed, size of wire in accordance with reference standard listed Table 2506.2, California Building Code.

E. Tie Wire: 18 gauge galvanized annealed.

F. Taping, Bedding and Finishing Compound: ASTM C475; compatible with tape and substrate.
1. USG SHEETROCK Brand Taping Joint Compound Ready-Mixed, drying-type, non-asbestos, vinyl base.
2. USG SHEETROCK Brand Topping Joint Compound Ready-Mixed, drying-type non-asbestos, vinyl base.
3. USG SHEETROCK Powder Joint Compound, drying-type, non-asbestos vinyl base, conventionally drying. For Taping and Topping.
4. USG SHEETROCK Powder Setting-type Joint Compound, chemical hardening.
5. Contractor's Option: USG SHEETROCK Lightweight All Purpose Joint Compound (Plus 3) with Dust Control.
6. USG SHEETROCK Brand All Purpose Joint Compound Ready-Mixed for laminating gypsum panels in multilayer partitions.
7. USG SHEETROCK Brand Joint Tape-Heavy, ASTM C475, high strength cross-fibered paper tape.
8. Drywall Primers: USG First Coat.
9. Or equal as approved in accordance with Division 01, General Requirements for substitutions.

G. Accessories: Corrosive Protective-Coated steel.
1. U-Trims: USG, Dietrich No. 200-A for joint compound or equal. .
2. J-Trim Casings, reveal type: USG, Dietrich No. 401 for 1/2" panels, 402 for 5/8" panels, no finishing compound.
3. Control Joint: Dietrich 093, USG Control Joint No. 093, Zinc metal.
4. Corner Bead: USG, Dietrich No. 103 for joint compounds or equal. .

H. Fasteners: Self-drilling tapping screws shall comply ASTM C 954; Self piercing screws shall comply ASTM C 1002;
1. ASTM C1002, No. 2 Phillips recessed, bugle head, power-driven. Nails not permitted.
2. Type S-12, ASTM C954, 16 gage steel studs, minimum penetration 3/8 inch.
3. Type S, ASTM C 1002, 20 gage steel studs, minimum penetration 3/8 inch.
4. Type G, gypsum board to gypsum board, minimum penetration 1/2 inch.
5. Type W, wood construction, minimum penetration 5/8 inch.

I. Reveal Moldings: Extruded aluminum moldings as detailed and as manufactured by Fry Reglet Co., Alhambra, CA, or equal as approved in accordance with Division 01, General Requirements for substitutions. All intersections shall be factory fabricated with joints heliarc welded and backs sealed with permanent waterproof tape. Furnish with 6 inch legs to join with straight sections. Provide connector clips at butt joints of straight sections and end caps at terminations. Color as selected by Architect.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. Fry Reglet Corp.
   b. Gordon, Inc.
   c. MM Systems Corporation.
   d. Pittcon Industries.
2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, alloy 6063-T5.
3. Finish: Anodized finish, Class II medium etch 0.40 mils, AA-M12C22A31, clear anodized

2.04 TEXTURE FINISHES

A. USG Spray Texture Finish: orange peel.

B. Primer as recommended by texture finish manufacturer.

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify that site conditions are ready to receive Work.

B. Beginning installation means acceptance of substrate.

3.02 PREPARATION

A. Delivery and Storage: Arrange for an adequate supply of materials on the jobsite so that progress of Work will be uninterrupted. Materials and accessories shall be delivered in original containers and bundles, and identified with the manufacturer's name and brand. Store gypsum board on flat, solid supports in dry areas, well protected from the elements.

B. Provide fixtures, anchors, sleeves, inserts and miscellaneous items, and provide openings and chases as necessary. Prior to closing in and finishing of dry wall Work, ascertain that piping, conduit, ductwork and fixtures which are to be concealed and which penetrate gypsum boards are in place, tested and approved.

C. Scaffolding: Construct, erect and maintain in conformance with applicable laws and ordinances.

D. Protection, Patching and Cleaning: Adjacent surfaces of other materials shall be protected from damage. Dry wall surfaces that have been cut out shall be neatly patched. Damaged or defective gypsum board finish shall be replaced. During progress of Work, rubbish droppings and water materials shall be removed.

3.03 CEILING FRAMING INSTALLATION

A. Framing for suspended ceilings and vertical curtain walls between dropped ceilings: Install to provide plumbed surfaces with no variation of more than 1/4 inch in 10 feet.

B. Ceilings shall not support material or building components other than grilles light fixtures, small electrical conduits and small ducts.
   1. Small Electrical Conduits: 3/4 inch in diameter or less, feeding electrical fixtures or electrical devices in the ceiling assembly.
   2. Large duct work, plumbing and like Work shall have its own support system and shall not be attached to the ceiling system.
   3. Only gypsum board dead loads shall be supported by cross-furring.

C. Ceiling Support System: Conform to Section 2506 and reference standard listed in Table 2506.2, California Building Code and DSA, IR 25-3.13, for sizes, types and spacing of ceiling support components.
   1. Main Runners: 1-1/2 inch, 0.475 pound per foot, cold-rolled channels, designated 150U050-54.
   2. Vertical hanger wires are #9 gauge (0.148" dia.) and galvanized conforming to ASTM A641. Soft temper and minimum tensile strength = 70 ksi.
   3. Cross-furring may be 7/8 inch hat sections, designated 087F125, 25 gauge galvanized hat sections at 24 inches maximum on centers.
   4. Main runners, spaced at 3 feet on centers, hanger wires shall be spaced at 4 feet maximum. To use hanger spacing of 4 feet on centers with a main runner spacing of 4 feet on centers, main runners shall be 1-1/2 inch hot-rolled channels weighing 1.12 pounds per foot.

D. Spacing of both hangers and runners: 48 by 48 inches is permissible if following conditions are met:
   1. Vertical hanger wires are 8 gauge and galvanized. If ceiling is non-accessible, 12 gauge wire may be used.
   2. Main runners are 1-1/2 inch channels, 1.12 pounds per foot minimum, hot rolled.
   3. Cross-furring may be 7/8 inch, 25 gauge galvanized hat sections at 24 inches maximum on centers.

E. Hangers: Provide Hanger wires for primary runners within 6 inches from ceiling perimeters.
   1. Hanger wires with ends twisted at least 3 times around itself, shall be saddle tied to primary runner channels.
   2. Primary runner channel shall be crossed with furring channels, saddle tied to runners with one strand of 16 gauge or two strands of 18 gauge tie wire. Runner channels shall be located not more than 6 inches from parallel boundary walls, or beams; furring channels 2 inches from parallel walls.
   3. Primary runner channels shall be spliced by lapping 12 inches and furring channels shall be spliced by lapping 8 inches. Splices shall be tied at 2 inches from each end with two loops of 16 gauge wire.
   4. Hanger wires that are more than 1 in 6 out of plumb shall have counterbraced wires. Wires shall not attach or bend around interfering material such as duct work. Trapeze or equivalent devices shall be used where obstructions interfere with direct suspension. Trapeze suspension shall have a minimum construction of back-to-back 1-1/2 inch cold formed channels for spans up to 6 ft.
   5. Ceiling wires and unbraced ducts, pipes and similar components must be separated.
   6. Refer to Division 01, General Requirements for size and testing requirements for concrete expansion anchor bolts and powder actuated fasteners.

7. Fasten hanger wires with not less than three (3) tight turns. Fasten bracing wires with four (4) tight turns. Make all tight turns within distance of 1-1/2 inches. Hanger or bracing wire anchors to structure should be installed in such manner that direction of wire aligns as closely as possible with direction of forces acting on wire.
    a. Wire turns made by machine where both strands have been deformed or bent in wrapping can waive 1-1/2 inch requirement, but number of turns should be maintained, and be as tight as possible.
8. Separate all ceiling hanging and bracing wires at least 6 inches from all unbraced ducts, pipes, conduit. It is acceptable to attach lightweight items, such as single electrical conduit not exceeding 3/4 inch nominal diameter, to hanger wires using connectors acceptable to the Division of the State Architect (DSA) .
9. When drilled-in (expansion) concrete anchors or shot-in (Powder-activated) anchors are used in reinforced concrete for hanger wires, 1 out of 10 must be field tested for 200 pounds in tension. When drilled-in anchors are used for bracing wires, 1 out of 2 must be field tested for 440 pounds in tension. Shot-in anchors in concrete are not permitted for bracing wires.
10. Provide trapeze or other supplementary support members at obstructions to typical hanger spacing. Provide additional hangers, struts or braces as required at all ceiling breaks, soffits or discontinuous areas. Hanger wires that are more than 1 in 6 out of plumb are to have counter-sloping wires.

F. Horizontal (Lateral) Support System:
1. Set of 4 splay wires shall be provided for each 12 by 12 feet. First set of splay wires shall be 4 feet from any wall. Wires shall be taut without causing ceiling to lift. Provide one vertical compression strut at each set of bracing wires per the following: DSA IR 25-3.
    a. Up to 48 inches in length: minimum, 4-inch stud, 20 gauge. Attach to main runners within 2 inch of cross runner with 2-#12 self-drilling self-tapping screws and to steel deck structure. At Wood Structure: 2-#12 x 2 inch screws or 3/16 inch diameter expansion anchor at concrete/steel deck. Compression strut shall not replace hanger wire.
    b. Up to 96 inches in length: back brace 4-inch brace stud with 4-inch stud, 20 gauge, screw perpendicular to center of brace stud with #10 screws at 24 inches on center. Attach to main runners within 2 inch of cross runner with 2-#12 self-drilling self-tapping screws and to steel deck structure. At Wood Structure: 2-#12 x 2 inch screws or 3/16 inch diameter expansion anchor at concrete/steel deck. Compression strut shall not replace hanger wire.
    c. And as indicated in drawings.
2. Splay wires shall be No. 12 gauge, with 4 tight turns at each end. Powder actuated fasteners shall not be used for attachment of splay wires to supporting structure.
3. Slope of splay wires shall not exceed 45 degrees from the plane of the ceiling and shall be taut. Splices in bracing wires are not to be permitted.
4. Ceiling grid members may be attached to not more than two adjacent walls. Ceiling grid members shall be at least 1/2 inch free of other walls. If walls run diagonally to ceiling grid system runners, one end of main and cross runners should be free, and minimum of 1/2 inch clear of wall.

5. Suspended ceiling systems with an area of 144 square feet or less, and fire rated ceiling systems with area of 96 square feet or less, surrounded by walls that connects directly to structure above, do not require bracing assemblies when attached to at least two adjacent walls.

G. Light Fixture Support:
1. Recessed or drop-in light fixtures shall be supported directly by main runners or by supplemental framing which is supported by main runners.
2. Surface mounted fixtures shall be attached to a main runner with a positive clamping device made of minimum 14 gauge metal. Rotational spring catches not allowed.
3. Light fixtures shall be attached to ceiling to resist horizontal force equal to weight of fixtures.
4. Install firestopping envelopes around recessed light fixtures and other electrical devices or boxes that exceed 100 sq. inches in 100 sq. ft where required to maintain designated fire rating of ceiling assembly.

H. Furring Channel Spacing: Furring channels at drywall ceilings shall be spaced at 16 inches on centers maximum.

3.04 GYPSUM BOARD INSTALLATION

A. Install gypsum board in accordance with ASTM C840, GA 201, GA 216 and Section 2508 California Building Code. Conform to DSA, IR 25-3.13.

B. Non-rated: Erect single layer gypsum board parallel or perpendicular on vertical framing, attached to studs and framing members with the specified fasteners spaced at 16" on center with screws and at top and bottom, 12" on center with screws at ceilings. Solid backing not required at joints running perpendicular to studs and framing members for walls.
1. For walls requiring STC 50 or higher, install extra layer of 1/2" gypsum board on one side, unless noted otherwise on wall schedule.

C. Rated: Erect single and double layer fire-rated gypsum board panels in accordance with Table 705.4, Note a, and Section 708 California Building Code, and GA-600, for one-hour, fire-rated, non-bearing Fire Walls or Fire Partitions, wood stud construction.
1. Gypsum board panels installed parallel to vertical studs or framing shall be spaced at 8" on center with screws at vertical edges, and 12" on center with screws in field and at top and bottom, and 12" on center with screws at ceilings. Solid backing not required at joints running perpendicular to studs and framing members for walls. Stagger vertical joints 24 inches on centers each side and opposite sides. Where joints are not staggered required minimum 24 inches, solid backing shall be provided. All joints shall be treated except as provided herein.

D. Treat cut edges and holes in moisture-resistant gypsum board with sealant.

E. Place control joints consistent with lines of building spaces as indicated or at maximum of 30 ft on centers. At rated walls, provide with fire rated panels same as wall construction.

F. Place corner beads at external corners. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials.

G. Seal all cutout and penetrations: For electrical, mechanical, plumbing and structural framing cutouts and penetration at interior surfaces. Per Section 07 92 00 for non-rated wall.

H. Install reveal moldings according to manufacturer's recommendations.

3.05 JOINT TREATMENT

A. Exposed gypsum board in wall areas and ceiling areas shall have joint compound and be taped and sanded per requirements of GA-114 for levels specified and ready for paint.

B. On installations where two layers of gypsum board are required, only the face layer will require finishing of joints and screwheads.

C. Fire-Rated Partitions: Perimeters of fire-rated partitions shall be caulked with fire-rated sealant as specified in Section 07 84 00, on both sides of partition.
   1. On the existing wall, caulk with fire-rated sealant as specified in Section 07 84 00 on new side of partition with double layer of fire-rated gypsum board. Refer to Drawings. .

D. Sound-Rated Partitions: Perimeters and penetrations of sound-rated partitions shall be caulked with acoustical sealant as specified in Section 07 92 00, both sides of partition.

E. Joints, except where excluded above including internal corners, shall be filled and taped. Thin uniform layer of joint compound, approximately 3 inches wide, shall be applied over joint. Tape shall be set in joint compound and finish levels required below. Internal angles, both horizontal and vertical, shall be reinforced and with tape folded to form straight and true angle. Metal external corners shall be set in place. Joints shall be allowed to dry at least 24 hours between each application of cement.

F. Gypsum board finish shall be to the following levels as defined by GA-214:
   1. Plenum areas above ceilings - Level 1.
   2. Areas receiving heavy textured paint - Level 3.
   3. Areas receiving vinyl wall covering, high impact wall covering, texture finish or light textured flat paint - Level 4.
   4. All Areas receiving Wall Coverings, non-textured, flat, egg-shell, gloss or semi-gloss paint - Level 5. Backroll application of sealer. Level 5 requires one of the following.
      a. Skim coat: A thin skim coat of joint compound, or a material manufactured especially for this purpose, shall be applied to entire surfaces. Surfaces shall be smooth and free of tool marks and ridges.
      b. Acrylic latex-based coating, spray apply: USG SHEETROCK Brand Primer-Surfacer Tuf-Hide or ProForm Surfacer/Primer by National Gypsum or equal. Apply to 15-20 mils wet film thickness to entire surface.
      c. "Smooth Coat" level 5 by Westpac Materials, Orange, CA.
      d. Additionally apply primer coat per Section 09 90 00 Painting.

3.06 TEXTURED FINISHES

A. Spray apply textured finishes to interior gypsum board where scheduled on drawings.

B. Provide Mock-up for Architect's approval before proceeding with Work.

C. Texture coat shall provide a uniform splatter pattern finish with an 80 percent minimum coverage of surface.

D. Utilized special equipment intended for specified texture finish.

E. Provide protection from spray for interior surfaces of electrical boxes and wiring.

3.07 TOLERANCES

A. Maximum Variation from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION

SECTION 09 51 00

ACOUSTICAL CEILINGS - LAY-IN

PART 1 - GENERAL

1.01 WORK INCLUDES

A. Acoustical panels, lay-in.

B. Related Sections:
   1. Section 01 35 42, CALGreen Requirements.
   2. Section 09 53 23, Acoustical Suspension Systems.

1.02 REFERENCE STANDARDS

A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.

B. CBC - California Building Code, 2016.

C. California Green Building Standards Code, CALGreen - 2016.

D. ASTM E84 - Surface Burning Characteristics of Building Materials.

E. ASTM E1264 - Acoustic Ceiling Products.

1.03 SUBMITTALS

A. Product data for acoustical panels.

B. Three samples illustrating material and finish of acoustic units.

C. Manufacturer's installation instructions.

D. CALGreen Submittals:
   1. Product Data Sheets and Declaration Statements showing compliance with CALGreen Code per 1.04.C.

1.04 QUALITY ASSURANCE

A. Qualifications
   1. Manufacturer: Company specializing in manufacture of ceiling panels with five years minimum experience.
   2. Installer: Company with three years minimum experience.

B. Fire Classification Requirements: ASTM E84, flame spread of less than 25 and smoke density rating of less than 450, Class I, California Building Code Table 803.11, 2016 CBC.

C. California Green Building Standards Code, CALGreen - 2016.

1. Adhesives, sealants, primers, and caulks shall comply with air quality management district rules where applicable, or SCAQMD Rule 1168 VOC limits, per CALGreen Tables 5.504.4.1 and 5.504.4.2.
2. Paints and Coatings shall comply with VOC limits in Table 1 of the ARB, per Table 5.504.4.3.
3. Composite wood products (plywood, particle board, medium density fiberboard) shall comply with Formaldehyde limits per CALGreen Table 5.504.4.5.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Interior wet work shall be completed prior to installation of panels. Windows and doors shall be in place. HVAC systems shall be installed and operable where necessary to maintain a temperature range of 60 to 85 degrees F and maximum 70 percent relative humidity.

1.06 WARRANTY

A. Acoustical Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace panels that fail within the warranty period. Failures include, but are not limited to the following:
   1. Acoustical Panels: Sagging and warping
   2. Grid System: Rusting and manufacturer's defects

B. Warranty Period:
   1. Acoustical panels: One (1) year from date of substantial completion

C. The Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

1.07 EXTRA STOCK

A. Provide extra quantity of acoustic units in the amount of one box of each type specified.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products of the following manufacturers form the basis for design and quality intended.
   1. Armstrong World Industries, Lancaster, PA.

B. Or equal as approved in accordance with Division 01, General Requirements for substitutions.

2.02 MATERIALS

A. Acoustical Panels: Armstrong Clean Room VL 870, Unperforated, ASTM E1264.
   1. Size: 24" x 48"
   2. Thickness: 5/8"

3. Light Reflectance: 0.80
4. CAC: Minimum 40
5. Edge: Square Lay-In
6. Surface Color: Factory White
7. Refer to Drawings.

B. Retention Clips: Armstrong #414 Retention Clip or equal. Refer to INSTALLATION Part 3 for conditions requiring clips.

C. Hold-Down Clips for kitchen and food service ceilings: Armstrong UHDC Clip at fire-rated corridors and exitways, manufacturer's standard at non-rated ceilings.

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify that existing conditions are ready to receive work.

B. Verify that layout of hangers will not interfere with installation of acoustic units.

C. Beginning of installation means acceptance of existing conditions.

3.02 INSTALLATION

A. Conform to Interpretation of Regulations - DSA IR 25-2.13.

B. Fit acoustic units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Where square units are indicated, lay directional patterned units in basket weave pattern. Fit border neatly against abutting surfaces.

D. Install acoustic units level, in uniform plane, and free from twist, warp and dents. Replace damaged or soiled units.

E. Provide for complete accessibility for all units.

F. Install Hold Down Clips at kitchen and food service ceilings.

G. Install Retention Clips at panels weighing more than 1/2 psf other than acoustical panels.

END OF SECTION

SECTION 09 53 23

ACOUSTICAL SUSPENSION SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Perimeter trim.

C. Related Sections:
   1. Section 09 51 00, Acoustical Ceilings.

1.02 REFERENCE STANDARDS

A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.

B. ASTM C635 - Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings

C. ASTM C636 - Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.

D. ASTM E84 - Surface Burning Characteristics of Building Materials.

E. ASTM E580 - Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint.

F. ASCE/SEI 7-10 - American Society of Civil Engineers/Structural Engineering Institute, Standard 7-10.

G. CBC - 2016 California Building Code.

H. Chapter 19A, 2016 California Building Code.

I. Chapter 23, 2016 California Building Code.

J. Metal Suspension Systems for Lay-in Panel Ceilings. Interpretation of Regulations - DSA IR 25-2.13.

1.03 SUBMITTALS

A. Shop drawings indicating, grid layout and related dimensioning, junctions with other work or ceiling finishes and interrelation of mechanical and electrical items. Photographic reproductions of the contract drawings shall not be used.

B. Product data.

C. Three samples of each suspension system main runner, cross runner and edge trim.

D. Manufacturer's installation instructions.

1.04 Submit one copy of ICC-ES Reports Armstrong ICC-ES, ESR-1308 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacture of ceiling suspension system with five years minimum experience.

B. Installer: Company with five years minimum experience.

C. Fire Classification Requirements: ASTM E84, all materials shall have Flame Spread Index rating of less than 25 and Smoke Developed Index rating of less than 450.

D. Products must comply with ICC-ES Reports.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products of following manufacturers form basis for design and quality intended.
1. Armstrong World Industries. Lancaster, PA. Product: Prelude XL, 15/16 inch Exposed Tee.

B. Or equal as approved in accordance with Division 01, General Requirements for substitutions.

2.02 SUSPENSION SYSTEM MATERIALS
1. Grid: ASTM C635, Armstrong Prelude Heavy Duty XL 15/16" ceiling system, galvanized components die cut and interlocking. Main Runners:
   a. Armstrong: Heavy Duty Prelude XL 7301, exposed T.
2. Cross Tees - "Stake-on end", Stepped End:
   a. Armstrong: XL7328 (24 inch grid), XL7341 (48 inch grid).
3. Edge Trim:
   a. Armstrong Angle Molding: 7800, 7/8", Prelude with BERC2 Retention Clip .

B. Beam End Retention Clip: slide clip for free end of main-runners and cross-tees with 2-inch movement capability.
1. Acceptable Product: Armstrong, BERC2, or equal,

C. Hold-Down Clips: Armstrong UHDC Clip (Universal Hold Down Clip) at fire-rated assemblies, fire-rated corridors, exitways and entryways, manufacturer's standard at non-rated ceilings.

D. Long Panel Stabilizer Clips: Armstrong #435, 3/4"- 1" thick, for panels 5' and longer.

E. Retention Clips: Armstrong #414 Retention Clip or equal. At non-rated ceilings.

F. Accessories: Stabilizer bars, panel stabilizer clips, adapters, splices, edge trim and all necessary components required for the specified suspended grid system.

G. Grid Materials: main runners, cross runners, splices, expansion devices and intersection connectors, commercial quality cold rolled steel with galvanized coating. Designed to carry a mean ultimate test load on not less than 180 lbs. compression and tension per ASTM E580 Section 5.1.2. The ceiling grid system must be rated as Heavy Duty as defined by ASTM C635.

H. Grid Finish: Factory applied standard white.

I. Hanger Wire: No. 12 gauge wire shall be 0.106 inch in diameter conforming to ASTM A641. No. 12 gage wire shall be soft annealed, galvanized steel wire with a Class 1 zinc coating.

J. Compression Struts, one of the following:
   1. Stud Design: Install a 20-gauge 4-inch stud. Attach to main runner with 2 #12 self-drilling self-tapping screws within 2 inches of splay intersection and to structure, with 2 #12 x 2 inch long screws to wood structure or 3/16-inch diameter expansion anchor at concrete/steel deck or 2 #10 x 1/2" self-tapping sheet metal screws to metal deck without concrete. Compression strut shall not replace hanger wire, refer to drawings. [DSA IR 25-2.13 Sheet No. 2.35.]
   2. Pipe Design: Install a 12 GA. vertical hanger wire and tie to main runner no more than 2 inches from splay intersection. Run the hanger wire inside a sleeved 1/2-inch Electrical Rigid Steel Conduit or Steel Electrical Metallic Tubing (EMT) and 3/4 inch Electrical Rigid Steel Conduit (ERSC) or Steel Electrical Metallic Tubing (EMT) as indicated on drawings, extend tubes tight to structure above and ceiling grid below. To secure sleeved tubes drill a 5/32-inch hole and install through a 1/8-inch bolt with locking nut, tubes shall lap one another min. 4 inches in fully extended position. Cut a slot in the 3/4-inch conduit to straddle the main runner and secure with 2 #12 self-tapping sheet metal screws.
   3. Install a USG DONN Compression Strut Posts, Model VSA18/30 for up to 30 inches plenum depth, Model VSA30/48 for up to 48 inches and VSA 48/84 for up to 84 inches and VSA84/102 for up to 102 inches. Provide required accessories for seismic requirements and secure per manufacturer's specifications. Compression strut post shall not replace hanger wire.
   4. Truss Joists Design: Install web stiffeners at 24 inches long. Attach clip angle L 2-1/2 by 2-1/2 by 1/4 inches and secure to joist with 3/8 inch diameter bolts with washers, hang splay wire from angle with 3/8 inch eyebolt, secured with washers and nut. Attach 1/2 inch diameter galvanized pipe strut, maximum length 51 inches, to side of joist or web stiffener with1/4 inch diameter. Lag bolt and washer, provide spacer between pipe and joist/stiffener.

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify that existing conditions are ready to receive work.

B. Verify that layout of hangers will not interfere with other work.

C. Beginning of installation means acceptance of existing conditions.

3.02 INSTALLATION

A. Install system in accordance with ASTM C636 and Section 5.2 of ASTM E580, CBC Sections 1616A.1.21 , and DSA IR 25-2.13, and as supplemented in this Section.

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

C. Exitways shall be installed in accordance with Section 13.5.6.2.2.(1) of ASCE 7-10 as amended by 2016 CBC Section 1616A.1.21. A main or cross runner shall be installed on all sides of each piece of tile, board or panel and each light fixture or grill. Splices and intersections of such runners shall be attached with through-connectors such as pop rivets screws, pins, plates with bent tabs or by other approved connectors.

D. Ceilings shall not support material or building components other than grilles or light fixtures except as herein provided. Ductwork, plumbing and like work shall have its own support system and shall not utilize the ceiling system or suspension wires.

E. No. 12 gage hanger wires may be used for up to and including 4 ft. by 4 ft. grid spacing and shall be attached to main runners.

F. Provide No. 12 gauge hanger wires at the ends of all main and cross runners within eight (8) inches of the support or within one-fourth (1/4) of the length of the end tee, whichever is least, for the perimeter of the ceiling area. Perimeter wires are not required when the length of the end tee is eight (8) inches or less.

G. Ceiling grid members shall be attached to two (2) adjacent walls per ASTM E580 Section 5.2.3 Ceiling grid members shall be at least 3/4 inch clear of other walls. If walls run diagonally to ceiling grid system runners, one end of main and cross runners should be free, and a minimum of 3/4 inch clear of wall.

H. The width of the perimeter supporting closure angle shall be not less than 2 inches. Grid systems with specialty or proprietary angles and support clips may be acceptable in accordance with Acceptance of Evaluation Reports and meeting the requirements of CBC Section 1616A.1.21, ASTM C635, C636 and E580.

I. At the perimeter of the ceiling area, where main or cross runners are not connected to the adjacent wall, provide interconnection between the runners at the free end to prevent lateral spreading. A metal spreader strut or a No. 16 gage wire with a positive mechanical connection to the runner may be used and placed within 8 inches of the wall. Where the perpendicular distance from the wall to the first parallel runner is 8 inches or less, this interlock is not required.

J. Expansion Joints, Seismic Separation Joints, and Penetration:
   1. Expansion joints shall be provided in the ceiling at intersections of corridors and at junctions of corridors with lobbies or other similar areas.
   2. For ceiling areas exceeding 2500 square feet a seismic separation joint shall be provided to divide the ceiling into areas not exceeding 2500 square feet. Alternatively comply with ASTM E580, Section 5.2.9.

3. Penetrations through the ceiling for sprinkler heads and other similar devices that are not integrally tied to the ceiling system in the lateral direction shall have a two (2) inch oversized ring, sleeve or adapter through the ceiling tile to allow free movement of one (1) inch in all horizontal directions. Alternatively, per ASTM E580, Section 5.2.8.5, a flexible sprinkler hose fitting that can accommodate one (1) inch of ceiling movement shall be permitted to be used in lieu of the oversized ring, sleeve or adapter.

K. Lateral Force Bracing:
1. Lateral force bracing is required for all ceiling areas. The spacing of the bracing assemblies as indicated on drawings.
   a. Exception: Lateral force bracing may be omitted for suspended acoustical ceiling systems with a ceiling area 144 sq. ft. or less, when perimeter support, in accordance with Paragraph H above or with ASTM E580 Sections 5.2.2 and 5.2.3, are provided and perimeter walls are designed to carry the ceiling lateral forces.
2. Provide lateral-force bracing assemblies consisting of a compression strut and four (4) No. 12 gage splayed bracing wires oriented 90 degrees from each other.
3. The spacing of the bracing assemblies must be shown on the construction documents.
4. There shall be a brace assembly a distance not more than one half (1/2) the calculated spacing from the surrounding wall, expansion joint and at the edges of any ceiling vertical offset.
5. Bracing assemblies spaced at a maximum of 12 feet by 12 feet on centers for school buildings and 8 feet by 12 feet on centers for essential services buildings, and
6. The slope of bracing wires shall not exceed 45 degrees from the plane of the ceiling and wires shall be taut. Splices in wires are not permitted without special approval.
7. Compression struts shall be adequate to resist the vertical component induced by the bracing wires, and shall not be more than 1 (horizontal) in 6 (vertical) out of plumb.
8. The maximum slenderness ratio (kL/R) of the compression strut is 200 or less.

L. Attachment of Hanger and Bracing Wires:
1. Fasten hanger wires with not less than three (3) tight turns in three inches. Hanger wire loops shall be tightly wrapped and sharply vent to prevent any vertical movement or rotation of the member within the loops.
2. Fasten bracing wires with four (4) tight turns. Make all tight turns within a distance of 1-1/2 inches.
3. Hanger or bracing wire anchors to the structure should be installed in such a manner that the direction of the anchor aligns as closely as possible with the direction of the wire.
4. Separate all ceiling hanger and bracing wires at least six (6) inches from all un-braced ducts, pipes, conduits, etc.
5. Hanger wires shall not attach to or bend around interfering materials or equipment. Provide trapeze or other supplementary support members at obstructions to typical hanger spacing. Provide additional hangers, struts or braces as required at all ceiling breaks, soffits, or discontinuous areas.

6. Hanger wires that are more than 1 (horizontal) in 6 (vertical) out of plumb shall have counter-sloping wires. Perimeter hanger wires at main runners that are positively attached to the perimeter closure angle, counter-sloping is optional.
7. When drilled-in concrete anchors or shot-in anchors are used in reinforced concrete for hanger wires, 1 of 10 wire/anchor assemblies must be field tested for 200 lbs. in tension. When drilled-in concrete anchors are used for bracing wires, 1 out of 2 wire/anchor assemblies must be field tested for 440 lbs. in tension in the direction of the wire. Power actuated fasteners in concrete are not permitted for bracing wires.

M. Ceiling Fixtures, Terminals, and Devices:
1. All fixture, terminals, and other devices shall be mounted in a manner that will not compromise ceiling performance in accordance with Section 13.5.6.2.2(5) of ASCE 7-10 as amended by 2016 CBC Section 1616A.1.21 (1616.10.16) and ASTM E580 Sections 5.3 and 5.4.
2. Attach all light fixtures and ceiling mounted air terminals, to the ceiling grid runners to resist a horizontal force equal to the weight of the fixtures. Screws or approved fasteners are required.
3. Ceiling panels shall not support any light fixtures, air terminals or devices.
4. All light fixtures shall be positively attached to the ceiling suspended systems by mechanical means to resist a horizontal force equal to the weight of the fixture. Screws or approved fasteners are required. A minimum of two attachments are required at each light fixture, per ASTM E580, Section 5.3.1.
5. Light fixtures weighing less than or equal to 10 lb shall have a minimum of (1) #12 gauge slack safety wire connected from the fixture housing to the structure above.
6. Light fixtures weighing greater than 10 lbs but less than 56 lbs may be supported directly on the ceiling runners, but they shall have a minimum of two (2) #12 gauge slack safety wires connected from the fixture housing at diagonal corners and anchored to the structure above.
7. Light fixtures weighing greater than 56 lbs. shall be independently supported by not less than four (4) taut No. 12 gauge wires, each attached to the housing and to the structure above. The four (4) # 12 taut #12 wires, including their attachment to the structure above, must be capable of supporting four (4) times the weight of the unit.
8. All 4ft. x 4 ft. light fixtures must have slack safety wires at each corner.
9. Surface-mounted fixtures shall be attached to the main runner with at least two positive clamping devices made of material with a minimum #14 gauge. Rotational spring catches do not comply. A #12 gauge suspension wire shall be attached to each clamping device to the structure above. Provide additional supports when light fixtures are eight (8) feet or longer. Maximum spacing between supports shall not exceed eight (8) feet.
10. Support pendant-mounted light fixtures directly from the structure above with hanger wires or cables passing through each pendant hanger and capable of supporting two (2) times the weight of the fixture. A bracing assembly is required where the pendant hanger penetrates the ceiling. If the pendant mounted light fixture is directly and independently braced below the ceiling, i.e. aircraft cables to walls, then brace assembly is not required above the ceiling.

11. If the pendant mounted light fixture is not directly and independently braced below the ceiling, than a bracing assembly is required where the pendant hanger penetrates the ceiling. Special details are required to attach the pendant hanger to the bracing assembly to transmit horizontal force. Exception: where the weight of the fixture is less than 20 pounds, the compression strut is not required.
12. Rigid conduit shall not be used for attachment of the fixtures.

N. Partitions: If non-bearing partitions that extend to and terminate at a suspended ceiling are supported laterally by opposing bracing wires spaced a maximum of 8 ft oc along the top edge of the partition or by other equivalent means, they shall be considered as not adding to the lateral load required to be resisted by the ceiling system.

O. Do not eccentrically load system or produce rotation of runners.

P. Install edge angle at intersection of ceiling and vertical surfaces using longest practical lengths. Miter corners. Provide edge angles at junctions with other interruptions. Where curved obstructions occur, provide preformed closers to match edge molding.

Q. Form expansion joints as indicated on drawings.

R. Install Hold Down Clips at panels weighing more than 1/2 psf other than acoustical panels.

S. Install Suspension Accent Trims per manufacturer's instructions including all related accessories.

T. Install Stabilizer Clips at panels 5' and longer at mid point of panel.

3.03 ADDITIONAL REQUIREMENTS

A. For Suspended Acoustical Ceilings Below Gypsum Board Ceilings: Where gypsum board or other ceiling finishes are attached to the framing, specific details will be required for the vertical hanger wire and lateral bracing wire support connections to the framing.

3.04 TOLERANCES

A. Variation from Flat and Level Surface: 1/8 inch in 10 feet.

END OF SECTION

SECTION 09 65 13

RESILIENT BASE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Resilient base, rubber.

B. Accessories.

C. Related Sections
1. Section 01 35 42, CALGreen Requirements.

1.02 REFERENCE STANDARDS

A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.

B. ASTM E648 and NFPA 253 - Critical Radiant Flux of Floor Covering Systems.

C. ASTM E662 - Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials.

D. ASTM F1861 - Resilient Wall Base

E. Local - Local Air Quality Management District Regulations Adhesive and Sealant Applications

F. California Green Building Standards Code, CALGreen - 2016.

1.03 FIRE CLASSIFICATION REQUIREMENTS

A. ASTM E648, NFPA 253: Class 1, Critical Radiant Flux Flame Spread Value: minimum 0.45 watts per sq cm.

B. ASTM E662, smoke density less than 450.

1.04 SUBMITTALS

A. Product data on specified products and colors available.

B. Three 6 inch long samples of base material for each color selected.

C. Manufacturer's installation instructions.

D. Maintenance procedures and recommended maintenance materials.

E. CALGreen Submittals:

1. Product Data Sheets and Declaration Statements showing compliance with CALGreen Code per 1.05.A.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Store materials for three days prior to installation in area of installation to achieve temperature stability.

B. Maintain minimum 70 degrees F temperature three days prior to, during and 24 hours after installation of materials.

C. Provide adequate ventilation to carry off volatile fumes.

1.06 WARRANTY

A. Submit under provisions of Division 01, General Requirements.

B. Provide manufacturer's 1 year warranty against defects and wear-through.

1.07 REPLACEMENT MATERIALS

A. Provide minimum three percent of all materials furnished for each color and size of materials installed.

PART 2 - PRODUCTS

2.01 MANUFACTURERS, RUBBER

A. Johnsonite, Chagrin Falls, OH.

B. Burke Mercer Flooring Products, San Jose, CA.

C. Nora Flooring Systems, Lawrence, MA.

D. Endura Co., Waltham, MA.

E. Roppe Corp., Fostoria, OH.

F. Or equal as approved in accordance with Division 01, General Requirements for substitutions.

2.02 BASE MATERIALS

A. Base: Rubber, 1/8 inch gauge, standard toe unless noted otherwise, 4 inches. Base material shall meet ASTM F1861 Type TS for rubber base, Group 1, Style A Straight (toeless) profile for carpet and Style B Coved profile for hard surface floors .

B. Base Accessories: size and color as base.

C. Adhesive: As recommended by the manufacturer and if full compliance with the California VOC regulations.

D. Non-aerosol adhesives applied on-site shall comply with VOC content limits defined by SCAQMD Rule 1168. Aerosol adhesives shall comply with VOC contents limits by Green Seal Standard GS-36.

E. Colors: as selected by Architect.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are smooth and flat with maximum variation of 1/8 inch in 10 ft and are ready to receive Work.

B. Verify that surfaces are finished, ready to receive base installation.

C. Beginning of installation means acceptance of existing substrate and site conditions.

3.02 INSTALLATION - BASE MATERIAL

A. Fit joints tight and vertical. Maintain minimum measurement of 18 inches between joints.

B. At 90 degree external corners: Cut from 120 foot rolls only, do not use 4 foot segments. At corners more or less than 90 degrees, shave a vertical strip down the back side of the material, 1/4 inch wide and not more than 1/2 the thickness at the point of bend. Bend coved toe to required angle. Bond material firmly to wall on both sides of joint to ensure a tight fit with no open void at top.

C. Inside Corners: Cut an inverted V-shaped notch in the toe of the wall base at the place where the corner is to be formed. Bend the base once or twice at a right angle to shape the corner. Form the corner and check the fit. Apply adhesive completely to the back of the base and to the wall area to be covered by the corner. Press firmly in position on and roll with a small hand roller.

D. Pre-molded units will not be accepted.

E. Install base on solid backing. Bond tight to wall and floor surfaces.

F. Scribe and fit to door frames and other interruptions.

3.03 CLEANING

A. Remove excess adhesive from floor, base and wall surfaces without damage.

B. Protection: Protect work until completion. Repair or make good any damage to this work and other materials damaged during installation of base material.

3.04 SCHEDULE

A. Install at all walls not specified to receive integral base and as scheduled in the finish schedule.

B. Do not apply base to toe kick at casework.

END OF SECTION

SECTION 09 65 15

COVE CAPS, REDUCERS AND TRANSITIONAL MOULDINGS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Reducers

B. Accessories.

C. Related Sections
1. Section 01 35 42, CALGreen Requirements.
2. Section 09 65 19, Resilient Tile Flooring.

1.02 REFERENCE STANDARDS

A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.

B. American Society for Testing and Materials (ASTM)
1. ASTM D-2047 - Static coefficient of friction.
2. ASTM D-2240 - Material hardness.
3. ASTM D-3389 - Resistance to tabor abrasion using H-18 wheels, 500 gram load, at 1,000 cycles.
4. ASTM E-648 - Test method for critical radiant flux of floor covering systems using a radiant energy source.
5. ASTM E-662 - Test method for specific density of smoke generated by solid materials.

C. National Fire Protection Association (NFPA)
1. NFPA 253 - Test method for critical radiant flux of floor covering systems using a radiant energy source.
2. NFPA 255 - Test method of surface burning characteristics of building materials (Steiner Tunnel Test).
3. NFPA 258 - Test method for specific density of smoke generated by solid materials.

D. California Building Code, 2016 CBC, Chapter 11B.

E. California Green Building Standards Code, CALGreen - 2016.

1.03 FIRE CLASSIFICATION REQUIREMENTS

A. ASTM E648, NFPA 253: Class I, Critical Radiant Flux: Minimum 0.45 watts per sq cm.

B. Smoke density not greater than 450 when tested in accordance with ASTM E66284.

1.04 SUBMITTALS

A. Product Data: Manufacturer's product data, installation instructions, and maintenance recommendations for each material proposed for use.

B. CALGreen Submittals:
   1. Product Data Sheets and Declaration Statements showing compliance with CALGreen Code per 1.05.C.

C. Samples: Verification samples of each product specified in color selected for use.

D. Certificates: Attesting fire rated materials tested by independent testing agency and comply with specifications.

1.05 QUALITY ASSURANCE

A. Manufacturer: Firm with minimum of 10 years experience in production of Cove caps, reducers, transitional mouldings and accessories.

B. Installer's Qualifications: Installer experienced (minimum of 2 years) to perform work of this Section, who has specialized in the installation of work similar to that required for this project and who is acceptable to the product manufacturer.

C. California Green Building Standards Code, CALGreen - 2016.
   1. Adhesives, sealants, primers, and caulks shall comply with air quality management district rules where applicable, or SCAQMD Rule 1168 VOC limits, per CALGreen Tables 5.504.4.1 and 5.504.4.2.
   2. Paints and Coatings shall comply with VOC limits in Table 1 of the ARB, per CALGreen Table 5.504.4.3

D. Materials: For each type of material required for the work of this Section, provide primary materials, which are the products of one manufacturer. Provide secondary materials, which are acceptable to the manufacturer of the primary materials. Comply with applicable regulations regarding VOC (volatile organic compound) content of the adhesives

1.06 ENVIRONMENTAL REQUIREMENTS

A. Store materials for three days prior to installation in area of installation to achieve temperature stability.

B. Maintain minimum 70 degrees F temperature three days prior to, during and 24 hours after installation of materials.

C. Provide adequate ventilation to carry off volatile fumes.

1.07 WARRANTY

A. Submit under provisions of Division 01, General Requirements.

B. Provide manufacturer's 1 year warranty against defects and wear-through.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products of following manufacturers form basis for design and quality intended.
   1. Johnsonite, Chagrin Falls, OH
   2. The Roppe Co., Fostoria, OH.
   3. BurkeMercer Products Co., Inc., Orlando, FL.
   4. The Flexco Co., Tuscumbia, AL.
   5. AFCO Rubber Corp., North Canton, OH.
   6. Schluter Systems.
   7. Genotek, Murrieta, GA.

B. Or equal as approved in accordance with Division 01, General Requirements for Substitutions.

2.02 COVE CAPS, REDUCERS, TRANSITIONAL MOULDINGS AND ACCESSORIES

A. Reducers
   1. Style and colors: Refer to Section 09 06 00 and related product Sections.
   2. Series: Johnsonite CRS, SSR, RRS, unless noted otherwise on drawings.
   3. Material: Homogeneous composition of polyvinyl chloride , high quality additives, and colorants.
   4. Length: 12' (3.66 m)
   5. Abrasion ASTM D-3389, H-18 wheel, 500 gram load Resistance: 1000 cycles, gram weight loss not greater than 1.
   6. Hardness: ASTM D-2240, Shore A, not less than 85.
   7. Slip Resistance: Static coefficient of friction (James Machine), ASTM D-2047, not less than 0.6.
   8. Flammability: ASTM E-648; NFPA 253; result to be not less than.45 watts per square centimeter, Class 1.
   9. Smoke Density: ASTM E-662; NFPA 258, smoke density less than 450.
   10. Asbestos-Free: Products shall contain no asbestos.

2.03 FILLERS AND ADHESIVES

A. Subfloor Filler: As recommended by the manufacturer.

B. Adhesives: As recommended by the manufacturer and in full compliance with California VOC regulations.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examination
   1. Verify that materials are suitable for installation. Do not proceed with work until unsatisfactory conditions are corrected. Comply with manufacturer's recommendations including the following:
      a. Substrates shall be clean and dry.

b. Substrates shall be free of depressions, raised areas, or other defects that would telegraph through the installed resilient material.
c. Temperature of resilient materials and substrate shall be within specified tolerances.

3.02 INSTALLATION

A. Installation of Reducers - Provide at all edges not covered by trim and at wall openings where abutting other finish flooring. Where doors occur, center edging strip below center of door.

B. Final Inspection - Prior to final inspection the contractor shall clean up the job site and remove all rubbish and debris. Remove excess adhesive from l surfaces. Floors are to be cleaned and readied or the appropriate finish.

3.03 CLEANING

A. Use only cleaning products recommended by manufacturer.

B. Protect installed product from damage and construction operations and inspect immediately before final acceptance of project.

END OF SECTION

SECTION 09 65 19

RESILIENT TILE FLOORING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Resilient tile flooring.

B. Accessories

C. Related Sections
1. Section 01 35 42, CALGreen Requirements.

1.02 REFERENCE STANDARDS

A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.

B. ASTM - American Society for Testing and Materials
1. ASTM E648 and NFPA 253 - Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.
2. ASTM E662 - Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials.
3. ASTM F 1700 - Standard Specification for Solid Vinyl Floor Tile
4. ASTM F 1869 - Test Method for Measuring Moisture Vapor Emission.
5. ASTM F 2170 - Determining Relative Humidity in Concrete Floor Slabs Using In-Situ Probes.

C. ADA - Americans with Disabilities Act of 1990
1. ADA Standards - ADA Title II Regulations and the 2010 ADA Standards for Accessible Design.

D. California Green Building Standards Code, CALGreen 2016.

E. SCAQMD - South Coast Air Quality Management District Regulations Rule 1168 Adhesive and Sealant Applications.

1.03 FIRE CLASSIFICATION REQUIREMENTS

A. ASTM E648, NFPA 253: Class I, Critical Radiant Flux: Minimum 0.45 watts per sq cm.

B. Smoke Density not greater than 450 when tested in accordance with ASTM E662.

1.04 SUBMITTALS

A. Product data on specified products, describing physical and performance characteristics, sizes, patterns and colors available.

B. Three samples, 12 by 12 inches in size, illustrating color and pattern for each floor material specified.

C. Manufacturer's installation instructions.

D. Maintenance procedures and recommended maintenance materials, and suggested schedule for cleaning, stripping and re-waxing.

E. Moisture and Alkalinity test results.

F. CALGreen Submittals:
   1. Product Data Sheets and Declaration Statements showing compliance with CALGreen Code per 1.05.A.

1.05 QUALITY ASSURANCE

A. California Green Building Standards Code, CALGreen 2016.
   1. Adhesives, sealants, primers and caulks shall comply with air quality management district rules where applicable or SCAQMD rule 1168 VOC limits, per CALGreen Tables 5.504.4.1 and 5.504.4.2.
   2. Paints and Coatings shall comply with VOC limits in Table 1 of the ARB, per CALGreen Table 5.504.4.3.

1.06 MOISTURE AND ALKALINITY TESTING

A. Contractor shall test all concrete floors to receive resilient flooring for moisture content as described in Division 01, General Requirements for Quality Requirements and this Section.

B. Notify Inspector 24 hours prior to installation of testing and at conclusion of tests.

C. Test concrete flooring in accordance with ASTM F1869 or ASTM F 2170.

D. Submit test results and data to Owner and Architect for approval prior to installation of flooring materials.

1.07 WARRANTY

A. Submit under provisions of Division 01, General Requirements.

B. For materials: 2 years from date of Substantial Completion.

C. Fur surface wear: 10 years from date of Substantial Completion.

D. For moisture vapor tolerance: 1 year from date of Substantial Completion.

1.08 ENVIRONMENTAL REQUIREMENTS

A. Store materials for three days prior to installation in area of installation to achieve temperature stability.

B. Maintain minimum 70 degrees F temperature three days prior to, during and 24 hours after installation of materials.

C. Provide adequate ventilation to carry off volatile fumes.

1.09 EXTRA MATERIALS

A. Provide minimum three percent of all materials furnished for each color and size of materials installed.

B. Maintenance Materials and Supplies: Provide instructions for maintenance of flooring from the manufacturer including cleaning solution, sealer and floor polish recommended by manufactures.

PART 2 - PRODUCTS

2.01 MANUFACTURERS - FLOORING

A. Products of the following manufacturers form the basis for design and quality intended.
   1. Gerflor USA

B. Or equal as approved in accordance with Division 01, General Requirements for Substitutions.

2.02 TILE FLOORING MATERIALS

A. Gerflor Creation Wood Series, ASTM F1700 Class III Type B:
   1. Overall thickness: not less than 0.10 inch.
   2. Wear-Layer Thickness: not less 0.028 inch.
   3. Max static load limit must exceed 800 psi.
   4. Applied Finish: Manufacturer's, factory-applied, permanent, laser and UV-cured, Gerflor PUR+
   5. Dimensions: as indicated on Drawings.
   6. Performance Criteria:
      a. Coefficient of Friction, ASTM D2047: 0.65 (Dry)
      b. Dimensional Stability, ASTM F2199: <0.02"
      c. Flexibility, ASTM F137: > 1.5"
      d. Fire Rating, ASTM E648, Class I
   7. Slip Resistant: Surfaces shall be stable, firm and slip resistant compliant with CBC 11B-302.1.
   8. Colors: as indicated on Drawings.

B. Subfloor Leveler System: Johnsonite LS-40, pieces to fit transition condition. Install per manufacture's specifications.

2.03 MANUFACTURERS - REDUCER STRIPS AND ACCESSORIES

A. Products of the following manufacturers form the basis for design and quality intended.
   1. Johnsonite, Chagrin Falls, OH
   2. The Roppe Co., Fostoria, OH.

3. Mercer Products Co., Inc., Orlando, FL.
4. The Flexco Co., Tuscumbia, AL.
5. AFCO Rubber Corp., North Canton, OH.

B. Or equal as approved in accordance with Division 01, General Requirements for Substitutions.

2.04 REDUCER STRIPS AND ACCESSORIES

A. Reducer Strip: JOHNSONITE, vinyl RRS-XX-C (1/8"), RRS-XX-B (.080") or RRS-XX-A (1/16") for thickness of flooring tile.

B. Edge Guards and Adapters: JOHNSONITE EG and CTA Series, thickness on each side of strip to accommodate type of flooring material to be jointed.

2.05 FILLERS AND ADHESIVES

A. Subfloor Filler: As recommended by manufacturer.

B. Adhesives: as recommended by the manufacturer and in full compliance with California VOC regulations.
1. Adhesives shall comply with VOC content limits defined by SCAQMD Rule 1168

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are smooth and flat with maximum variation of 1/8 inch in 10 ft, and are ready to receive Work.

B. Prior to ordering resilient sheet flooring, conduct Calcium-Chloride Test Method in accordance with ASTM F1869 to verify that concrete floor slabs are dry with maximum moisture vapor emissions of 3 pounds per 1,000 square feet in 24 hours and that slabs exhibit negative alkalinity, carbonation or dusting. Apply the moisture test in four (4) different areas of each floor location, with at least one test for each 1,000 square feet of floor area.

C. Prior to ordering resilient flooring conduct Relative Humidity Test Method in accordance with ASTM F 2170 to verify relative humidity and surface pH in accordance with ASTM F710 of concrete floor slabs, the method
1. Requires drilling holes at diameter not to exceed outside diameter of probe by more than 0.04 inch to depth equal to 40 percent of slab's thickness (elevated structural slab shall be tested at depth equal to 20 percent of slab thickness).
2. Place probe to full depth of test hole, place cap over probe.
3. Permit test site to acclimate, or equilibrate, for 72 hours prior to taking relative humidity readings.
4. Remove cap and press button on the probe to obtain reading.
5. Relative humidity readings for substrates receiving non-permeable flooring are 75 percent or lower.
6. Testing shall require 3 tests in first 1,000 square feet, with one additional test per each additional 1,000 square feet of concrete slab surface.

7. Alkalinity testing: follow procedures per ASTM F710, ranges shall not exceed those recommended by the flooring manufacturer.

D. Alkalinity Testing: Concrete floors shall be tested for alkalinity prior to the installation of resilient flooring. Levels of pH shall not exceed the written recommendations of the resilient flooring manufacturer or the adhesive manufacturer, or both.

E. Ordering of flooring materials and beginning of installation means acceptance of existing substrate and site conditions.

3.02 PREPARATION

A. Install Vapor Emission Treatment Systems where tests reveal presence of more than acceptable moisture level in accordance with Test Method ASTM F 1869 or ASTM F 2170

B. Preparation of Floors - Concrete substrate: Surfaces to receive tile shall be scraped of foreign deposits. Subfloor filler shall be applied to the extent necessary to bring all depressions smooth and level.

C. Preparation of Floors - Wood Floors: Surfaces to receive tile shall be scraped of foreign depressions up to existing grade. Nail or staples shall not protrude above the surface of the wood. All depressions from nails, staples or gouges shall be filled in.
1. Preparation for Underlayment - Subfloor areas that have been asbestos abated shall be securely fastened, structurally sound and free of all foreign matter and projections. Reset any protruding nails. Subfloor shall be patched as necessary to fill gouges, level uneven areas prior to underlayment installation. Strictly adhere to manufacturer installation instructions.
2. Provide site specific written underlayment warranty from manufacturer.

D. Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes, feather edges and fill other defects with subfloor filler.

E. Apply, trowel and float filler to leave a smooth, flat, hard surface, free of bumps or depressions of any size.
1. Latex Underlayment - Latex modified, Portland cement based formulation or approved by flooring manufacturer for applications indicated. Ardex SD-F or equal. Product that will not disintegrate from moisture, for floor areas less than 1/4 inch buildup. All products shall be 100 percent asbestos-free.

F. Inspection - After floor surface has been prepared as described above and before application of adhesive, contractor must notify Inspector on any evidence of possible moisture problems.

G. Prohibit traffic from area until filler is cured.

H. Vacuum clean substrate.

I. Apply primer as recommended by the materials manufacturer.

3.03 INSTALLATION - TILE MATERIAL

A. Install in accordance with manufacturers' instructions.

B. Spread only enough adhesive to permit installation of materials before initial set.

C. Terminate flooring at centerline of door at door openings where adjacent floor finish is dissimilar.

D. Install edge strips at unprotected or exposed edges, and where flooring terminates.

E. Scribe flooring to walls, columns, cabinets, floor outlets and other appurtenances to produce tight joints.

F. Install flooring under movable partitions and under open cabinets without interrupting floor pattern.

G. Install edge strips where flooring does not terminate at walls and where indicated. Fit joints tightly.

H. Install wall base in accordance with Section 09 65 13.

I. Installation - Shall meet manufacturer's written installation specifications and industry standards. Finish product shall have tiles of equal width at opposite edges of room. Avoid cut widths that equal less than one-half of tile at the perimeter. Tiles , when cut, shall butt neatly and tightly to vertical surfaces and permanent fixtures, including edgings, thresholds and nosing.

J. Installation of Cove Base - Install after floor plank is in place. Edges to align top and bottom, and joints to fit tight.

K. Installation of Reducers, Transitions or Edging Strips - Provide at all edges not covered by trim and at wall openings where abutting other finish flooring. Where doors occur, center edging strip below center of door.

L. Final Inspection - Prior to final inspection the contractor shall clean up the job site and remove all rubbish and debris. Remove excess adhesive from floor, base, and wall surfaces. Floors are to be cleaned and readied for the appropriate finish.

3.04 PROTECTION

A. Prohibit traffic on floor finish for 48 hours after installation.

B. Apply protective floor polish to floor surfaces that are free from soil, visible adhesive, and surface blemishes.

C. Cover products installed on floor surfaces with undyed, untreated building paper until final inspection.

D. Use of dollies with boards underneath whenever normally stationary equipment and/or furnishings must be moved across the floor.

E. Protect floors from rolling loads for 72 hours after installation by covering with hardboard or plywood.

3.05 CLEANING

A. Remove excess adhesive from floor, base and wall surfaces without damage.
   1. Remove marks and blemishes from flooring surfaces.
   2. Sweep and then vacuum flooring.
   3. Damp-mop flooring to remove soiling.

B. Protection: Cover Work with a heavy non-asphaltic non-staining type building paper where subsequent building operations occur. Protect Work until completion. Repair or make good any damage to this Work and other materials damaged during installation of flooring.

END OF SECTION

SECTION 09 90 00

PAINTING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Fluid applied paints and coatings. Upon completion of Work, all visible interior surfaces, within the Contract limits shall be painted unless scheduled "Not to Be Painted in this Section."
   1. Each paint system includes:
      a. Surface preparation, including touch-up of shop applied primers, if needed.
      b. Prime coat application, where scheduled as part of finish system.
      c. Finish coat application, where scheduled apply two or more finish coats.
   2. Paint semi-concealed areas (e.g. inside of light troughs and valances, behind grilles, and projecting edges above and below sight lines, behind wall-mounted items).

B. Surfaces Not to be Painted:
   1. Prefinished wall, ceiling, and floor coverings.
   2. Items with factory-applied final finish .
   3. Concealed ducts, pipes, and conduit.
   4. Glass, plastic laminate, ceramic tile, anodized aluminum.
   5. Surfaces of steel items that will be embedded in concrete.
   6. Surfaces specifically scheduled or noted on the Drawings not to be painted.
   7. Fire-Rating labels on doors and frames.
   8. Performance labels on doors and frames.

C. Related Sections:
   1. Section 01 35 42, CALGreen Requirements.

1.02 REFERENCE STANDARDS

A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.

B. ASTM International - American Society for Testing and Materials
   1. ASTM D 4442 - Direct Moisture Content Measurement of Wood and Wood-Base Materials.
   2. ASTM D 4444 - Use and Calibration of Hand-Held Moisture Meters.
   3. ASTM D 6386 - Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting.

C. California Green Building Standards Code, CALGreen 2016.

D. SDAPCD - San Diego County Air Pollution Control District, Regulation IV.

E. SSPC - Steel Structures Painting Council.

1.03 SUBMITTALS

A. CALGreen Submittals:
   1. Product Data Sheets and Declaration Statements showing compliance with CALGreen Code per 1.06.A.

B. Product Data: For each paint system product and accessory item.

C. Samples: Of each specified finish system color, texture, and sheen; samples shall be minimum 8-1/2 by 11 inches in size.
   1. Prepare transparent wood finish samples on type and quality of wood specified.

D. Certified copies of moisture test results.

E. Informational Submittals:
   1. Statement of Qualifications from manufacturer.
   2. Statement of Qualifications from installer.
   3. Manufacturer's application instructions.

F. Closeout Submittals
   1. Material Safety Data Sheets.

G. Submit Qualifications data for manufacturer and applicator [, and sign painter] required under Quality Assurance.

1.04 MAINTENANCE MATERIALS AND SUBMITTALS

A. For each color, type, and gloss of paint used in the work provide, as Extra Materials, a quantity equal to approximately 10 percent of the quantity required for its installation rounded to the nearest gallon, or five gallons, whichever is less.
   1. Extra Materials shall be from the same production run as installed materials.
   2. Label each container with locations and dates of related installations; do not obscure manufacturer's label.
   3. Deliver Extra Materials to Site as directed by Owner.

1.05 QUALITY ASSURANCE

A. California Green Building Standards Code, CALGreen 2016.
   1. Adhesives, sealants, primers and caulks shall comply with air quality management district rules where applicable, or SCAQMD Rule 1168 VOC limits, per CALGreen Tables 5.504.4.1 and 5.504.4.2.
   2. Paints and Coatings shall comply with VOC limits in Table 1 of the ARB, per CALGreen Table 5.504.4.3.

B. Manufacturer's Qualifications: Company with minimum 10-years' experience manufacturing quality paint and finish products for commercial projects similar in scale and complexity to those required for this Project.

C. Applicator Qualifications: Company with minimum 5-years' experience painting and finishing commercial projects similar in scale and complexity to those required for this Project.

D. Materials, for each paint system, shall be by, or as recommended by, a single coating manufacturer for use together in commercial quality paint / coating system for the substrate and exposure conditions indicated.

E. Regulatory Requirements
   1. Conform to AQMD Regulations for maximum VOC limits.
   2. Comply with applicable codes and regulations of authorities having jurisdiction including those with jurisdiction over airborne emissions and industrial waste disposal. Where those requirements conflict with this Specification, comply with the more stringent provisions.

F. Field Samples: Provide Field Sample of each finish system color, texture, and sheen scheduled. Do not proceed with coating application until sample panel has been approved.
   1. Field Sample shall be full height of wall by 10-feet.
   2. Locate as approved by Architect.
   3. Adjust materials and methods of installation as required to obtain Architect's approval.
   4. Document materials and methods used to obtain Architect's approval and maintain at least one copy of this documentation on site while related work is in progress.
   5. Maintain access to and protect Field Sample from damage while related work is in progress.
   6. Upon acceptance of related work, approved sample may remain as part of Work.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver products to site in their original, sealed, undamaged containers with labels intact and legible.
   1. Labels shall include manufacturer's name, type of paint, brand name, brand code, color designation, recommended surface preparation, typical coverage, drying times, cleanup procedures, and instructions for mixing and reducing, if permitted.

B. Store paint materials ambient temperatures between 45- and 90-degrees F, in well ventilated area unless permitted otherwise by manufacturer's instructions.

C. Take precautionary measures to prevent fire hazards and spontaneous combustion.

1.07 FIELD CONDITIONS

A. Supply continuous ventilation and heating facilities to maintain surface and ambient temperatures above 45-degrees F for 24-hours before, during and 48-hours after application of finishes, unless permitted otherwise by manufacturer's instructions.

B. Do not apply exterior coatings during rain, or when relative humidity is above 50 percent, unless permitted otherwise by manufacturer's instructions.

C. Minimum application temperatures for Latex Paints: 45-degrees F for interiors; 50-degrees F for exterior; unless required otherwise by manufacturer's instructions.

D. Minimum application temperature for Varnish and Transparent Finishes: 65-degrees F for interior or exterior, unless permitted otherwise by manufacturer's instructions.

E. Maintain lighting level sufficient to conduct painting operations.

1.08 GUARANTEE

A. Guarantee the painting Work against peeling, fading, cracking, blistering or crazing for a period of two years form the Date of Certified Completion for painting of new surfaces and existing surfaces.

PART 2 - PRODUCTS

2.01 PAINTS AND COATINGS

A. Acceptable Manufacturers: Products of following manufacturers form basis for design and quality intended.
   1. Dunn-Edwards Corporation, Los Angeles, CA.

B. Or equal, approved in accordance with Division 01, General Requirements, for substitutions.

2.02 MATERIALS

A. Coatings: Ready mixed, except field-catalyzed coatings. Process pigments to soft past consistency, capable of being readily and uniformly dispersed to homogenous coating.

B. Colors and Glosses: As scheduled on the Drawings. Architect will select color and hue to be used in various types of paint specified and will be sole judge of acceptability of various glosses obtained from materials proposed to be used in Work. During actual painting, Architect may make minor modifications in tone and shade to adjust for actual surface and lighting conditions encountered.

C. Undercoats and Thinners: Provide undercoat paint produced by same manufacturer as finish coat. Use only thinners recommended by paint manufacturer and use only to recommended limits. Use undercoat, finish coat and thinner material as parts of a unified system of paint finish.

D. Coatings: Good flow and brushing properties; capable of drying or curing free of streaks or sags.

E. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified of commercial quality.

2.03 APPLICATION EQUIPMENT

A. For application of the approved paint, use only such equipment as is recommended by the manufacturer.

B. Compatibility: Prior to actual use of application equipment, use all means necessary to verify that the proposed equipment is actually compatible with the material to be applied and that the integrity of the finish will not be jeopardized by the use of the proposed application equipment.

2.04 FINISHES

A. Refer to schedule at end of Section for surface finish and the drawings. Notwithstanding product numbers listed in schedule, Contractor shall conform to most recent product numbers as published by the manufacturer.

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify that surfaces are ready to receive Work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of Work. Report any condition that may potentially affect proper application.

C. Measure moisture content of new surfaces using an electronic moisture meter. Apply finishes only when moisture content of surfaces are below the following maximums. Conduct moisture measurements in presence of the project inspector, document readings and submit to Architect under Part 1.
   1. Gypsum Wallboard: 12 percent.

D. Beginning installation means acceptance of existing surfaces and conditions.

3.02 MATERIALS PREPARATION

A. Mix and prepare painting material in accordance with manufacturer’s recommendations.

B. Store materials not in actual use in tightly covered containers.

C. Maintain containers used in storage, mixing and application of paint in a clean condition, free from foreign materials and residue.

D. Stir all materials before application to produce a mixture of uniform density and as required during the application of materials. Do not stir into the material any film that may form on the surface. Remove the film and strain the material before using.

3.03 SURFACE PREPARATION

A. Remove electrical plates, hardware, light fixture trim and fittings prior to preparing surfaces for finishing.

B. Correct minor defects and clean surfaces which surfaces which affect Work of this section.

C. Shellac and seal marks that may bleed through surface finishes.

D. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

E. Insulated Coverings: Remove dirt, grease and oil from canvas and cotton.

F. Gypsum Board Surfaces: Fill minor defects, joints and nail head depressions with spackling compounds. Prime in accordance with primer manufacturer's recommendations. Apply primer over skim coat for Level 5 finish.

G. Galvanized Surfaces:
   1. Prepare galvanized steel and nonferrous metal surfaces in accordance with ASTM D 6386-Surface Preparation of Galvanized Surfaces and manufacturer's instructions.
   2. Ensure surfaces are dry.
   3. Interior Exposure (Dry/Benign): Remove visible, oil, grease, dirt, dust, protective mill coatings, and other soluble contaminants in accordance with SSPC-SP 1 or manufacturer's instructions as specified for coating system. Hand or Power tool clean to remove all insoluble contaminants.
   4. Interior and Exterior Exposure (moderate to severe): Remove visible oil, grease, dirt, dust, protective mill coatings, and other soluble contaminants in accordance with SSPC-SP 1 or manufacturer's instructions as specified for coating system. Follow initial cleaning with one of the following Methods:
      a. SURFACE PREPARATION METHOD A (Preferred): Thoroughly roughen the entire surface to be coated using compressed air brush off blast cleaning with a fine abrasive to achieve a uniform anchor profile of 1-2 mils. reference ASTM D 6386-99 (2005) Section 5.4.1.
      b. SURFACE PREPARATION METHOD B (Alternative method when Method A is not feasible): Chemically Treat with one of the following products to etch the galvanized surface to be coated: Henkel Galvaprep 5 or Clean & Etch by Great Lakes Laboratory. Reference ASTM D 6386-99 (2005) Section 5.4.2.

H. Door Frames, Side Lights, Jambs and Headers: clean and light sand smooth.

I. Previously Coated Surfaces: As required in Section 09 01 90.

3.04 PROTECTION

A. Protect elements surrounding the Work of this Section from damage or disfiguration.

B. Repair damage to other surfaces caused by Work of this Section.

C. Furnish drop cloths, shields and protective methods to prevent spray or droppings from disfiguring other surfaces.

D. Remove empty paint containers from site.

3.05 APPLICATION

A. Apply products in accordance with manufacturer's instructions.

B. Do not apply finishes to surfaces that are not dry.

C. Apply each coat to uniform finish. Number of coats specified is a minimum. Additional coats shall be applied at no extra cost, if coatings show evidence of uneven application, uneven pigmentation, brush strokes or otherwise unsatisfactory distribution of material.

D. Under coats shall be lighter and brighter in tint that finish coat.

E. Sand lightly between coats to achieve required finish.

F. Allow applied coat to dry before next coat is applied.

G. Where clear finishes are required, tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

H. Prime back surfaces of interior and exterior woodwork with primer paint.

I. Prime back surfaces of interior woodwork scheduled to receive stain or varnish finish with floss varnish reduced 25 percent with mineral spirits.

J. Seal tops, bottoms and cutouts for hardware and accessories of wood doors and plastic-laminate covered doors.

K. Paint Frames: Split paint door frames to match color of walls on each side of opening unless directed otherwise by Architect.

L. Paint finish shall continue through behind all wall-mounted items (e.g. markerboards, peg boards, and tack boards).

3.06 CLEANING

A. As Work proceeds, promptly remove paint where spilled, splashed, or spattered.

B. During progress of Work maintain premises free of unnecessary accumulation of tools, equipment, surplus materials and debris.

C. Collect cotton waste, cloths, and material that may constitute a fire hazard, place in closed metal containers and remove daily from site.

3.07 FINISH SYSTEM SCHEDULE - INTERIOR SURFACES

		Dunn-Edwards
A.	Gypsum Board - Eggshell - Acrylic (Skim Coat required for Level 5 finish)	
1.	Primer, 1 Coat	VNPL00
2.	Tie Coat, 1 Coat	SWLL20
3.	Finish, 2 Coats	SWLL20
B.	Gypsum Board - Gloss - Acrylic (Skim Coat required for Level 5 finish)	
1.	Primer, 1 Coat	VNPL00
2.	Tie Coat, 1 Coat	EVSH60
3.	Finish, 2 Coats	EVSH60
C.	Ferrous - Semi-Gloss - Acrylic	
1.	Primer, 1 Coat	BRPR00
2.	Tie Coat, 1 Coat	SWLL50
3.	Finish, 1 Coat	SWLL50
D.	Ferrous - Factory Primed. If shop primer is compatible with scheduled finish, clean and touch-up prime coat then apply Finish as scheduled.	
E.	Galvanized and Aluminum - Semi-Gloss - Acrylic	
1.	Surface Prep	SCME-01 SP1
2.	Primer, 1 Coat	ULGM00
3.	Finish, 2 Coats	ULSH60
4.	Finish, 2 Coats (Stainless Steel)	ULSH60

END OF SECTION

SECTION 10 11 16

MARKERBOARDS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Markerboards, dry-erase, magnetic.

B. Trim, chalkrail and accessories.

1.02 REFERENCE STANDARDS

A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.

B. ASTM B209 - Aluminum-Alloy Sheet and Plate.

C. ASTM A653/A 653M Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

D. ASTM B221 - Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes.

E. PEI - Porcelain Enamel Institute - Performance Specifications for Porcelain Enamel Markerboards.

F. ASTM A424 - Sheet Steel for Porcelain Enameling.

G. ANSI A208.1 - Mat Formed Wood Particleboard.

1.03 SUBMITTALS

A. Shop drawings indicating, wall elevations, sizes, dimensions and joint locations between panels, and mounting details.

B. Provide product data on trim and accessories.

C. Three samples illustrating materials and finish, color and texture of markerboard.

D. Include maintenance information on regular cleaning, stain removal and removal of damaged components.

1.04 WARRANTY

A. General Warranty: Special Markerboard warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of Contract Documents.

B. Markerboard Warranty: Submit written warranty executed by manufacturer agreeing to replace porcelain-on-steel markerboards that do not retain their original writing and erasing qualities, become slick and shiny, or exhibit crazing, cracking, or flaking within specified warranty period, provided manufacturer's written instructions for handling, installation, protection, and maintenance have been followed.

C. Warranty Period: Life of building.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products of following manufacturers form basis for design and quality intended.
1. Platinum Visual Systems/ABC School Equipment, Inc., Corona, CA.
2. Egan Visual, Inc./The Scheffey Group, Los Angeles, CA.
3. ADP Lemco Inc., Salt Lake City, UT.
4. Marsh Industries, New Philadelphia, OH.

B. Or equal as approved in accordance with Division 01, General Requirements for Substitutions.

2.02 MATERIALS

A. Sheet Steel: ASTM A424, minimum 28 gauge , .
1. Can support papers by means of magnets [with Dry-erase qualities]. Quantities of magnets: As required by Architect.
2. Color: white, low sheen.

B. Sheet Steel: ASTM A653, galvanized to G60 designation.

C. Aluminum Sheet: ASTM B209, H1100 Alloy H-19 temper

D. Aluminum Extrusions: ASTM B221, 6061 alloy, T5 temper

E. Particle Board: ANSI A208.1; wood chips or shavings set with waterproof resin binder, sanded faces.

F. Adhesives: Type recommended by manufacturer. Waterproof type.

2.03 ACCESSORIES

A. Map Supports: Formed aluminum roller brackets, sliding type to fit map rail.

B. Provide instructions for markerboard cleaning.

C. Manufacturer's standard support clip , hangers, and accessories for markerboards to function properly.

2.04 FABRICATION - MARKERBOARDS

A. Outer Face Sheet: Platinum Visual Systems Writanium , ASTM A424, steel, 0.0150" thick, with vitreous porcelain enamel finish, primer, ground and cover coat. Markerboards 16 feet and wider: 0.0240" thick and routed steel splined joint .

B. Core: ANSI A208.1, particleboard; 1/2 inch thick Industrial Grade M2 .

C. Backing Surface: ASTM B209, aluminum sheet, 0.015 inch thick, or ASTM A653, 26 gauge galvanized steel.

D. Sizes: Refer to Drawings for sizes, locations and quantities.

E. Frame: aluminum frame .

2.05 FRAME AND TRIM

A. Frame: Extruded aluminum; Platinum Visual Systems STS SERIES Series except with 0.015" aluminum backing, concealed fasteners :
1. Display (map) Rail: 2 inch, with natural cork insert, 1/4" thick, with vinyl covering, full length of markerboard. Vinyl to match tackboard vinyl.
2. Head and Side Trims: C-18, 1-1/2" aluminum trim, 0.062", clear anodized.
3. Mullion Trim at markerboards 16’ and wider: Butt joints, routed steel splined joints.

B. Marker tray: Platinum Visual Systems, blade profile marker tray, extruded aluminum, full {partial} length of markerboard, solid sections with smooth curved ends , concealed fasteners.

C. Provide 1 each map hook every 2 linear ft of maprail and two roller brackets for each markerboard unit. One flag holder per room.

2.06 FINISHES

A. Porcelain Enamel: Glass fired enamel in accordance with PEI Type A. Color, white or similar, as selected from manufacturer's standard range, low sheen.

B. Aluminum Frame and Accessories: Anodized to clear natural finish.

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify that surfaces and internal wall blocking are ready to receive Work and dimensions are as indicated on shop drawings.

B. Beginning of installation means acceptance of substrate construction.

3.02 INSTALLATION

A. Install markerboards in accordance with manufacturer's instructions.

B. Establish bottom of frame perimeter as approved by Architect.

C. Secure units level and plumb.

D. Where markerboard adjoins tackboard or chalkboard, join panels with H/Bar divider joint.

E. NO holes in markerboard permitted.

3.03 CLEANING

A. Clean markerboard surfaces and aluminum in accordance with manufacturer's instructions.

B. Cover markerboard surfaces with clear protective covering.

C. Remove protective cover at Date of Notice of Completion.

END OF SECTION

SECTION 10 11 23

TACKBOARDS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Modular tackboard units.

B. Trim and accessories.

1.02 REFERENCE STANDARDS

A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.

B. ASTM A526 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality.

C. ASTM B209 - Aluminum-Alloy Sheet and Plate.

D. ASTM B221 - Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes.

E. ASTM E84 - Surface Burning Characteristics of Building Materials.

F. FS CCC-W-408 - Wall Covering, Vinyl Coated.

G. Chapter 8, 2016 California Building Code.

1.03 REGULATORY REQUIREMENTS

A. Conform to Table 803.1.1, California Building Code. Maximum flame spread: 75, maximum smoke density 450, ASTM E84.

1.04 SUBMITTALS

A. Shop drawings indicating, wall elevations, dimensions and joint locations.

B. Product data on tackboard surface covering, trim and accessories.

C. Three samples illustrating materials and finish, color and texture of tackboard surfacing.

D. Manufacturer's installation instructions.

E. Maintenance information on regular cleaning, stain removal and removal of damaged components.

1.05 WARRANTY

A. Provide five year warranty. Include coverage of tackboard surface from delamination.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products of following manufacturers form basis for design and quality intended.
   1. Platinum Visual Systems/ABC School Equipment, Inc., Corona, CA.
   2. Steelcase/Polyvision Corp./Nelson-Adams, Norcross, GA.
   3. ADP Lemco Inc., Salt Lake City, UT.
   4. Claridge Products and Equipment, Inc., Harrison, AR.
   5. Egan Visual, Inc./The Scheffey Group, Los Angeles, CA.
   6. Chatfield-Clarke Company, Fontana, CA.
   7. Forbo Linoleum, Inc., Hazleton, PA.
   8. LBI/BOYD, Inc., Glendora, CA; Product: FRtack.

B. Or equal as approved in accordance with Division 01 General Requirements for Substitutions.

2.02 MATERIALS

A. Colored Cork Tackboard Materials: Platinum Visual Systems Model NTS with CH235 frame, and HB235 Hanger Bar.
   1. Face Sheet: Colored cork surface shall be 1/4" resilient homogenous tackable linoleum surface consisting of linseed oil, granulated cork, rosin binders and dry pigments calendared onto natural burlap backing. Color shall extend through thickness of material and be self-healing.
   2. Core Material: 1/4" medium density fiberboard
   3. Metal Trim: 6063 aluminum alloy with T5 temper.
   4. Adhesive: as recommended by manufacturer.

B. Sizes: As indicated on Drawings.

C. Colors: as indicated on Drawings..

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify that surfaces and internal wall blocking are ready to receive Work and dimensions are as indicated on shop drawings.

B. Beginning of installation means acceptance of substrate construction.

3.02 INSTALLATION

A. Install tackboards in accordance with manufacturer's instructions.

B. Establish bottom of frame perimeter as approved by Architect.

C. Secure units level and plumb.

D. Where tackboard adjoins chalkboard or markerboard, join panels with extruded aluminum trim.

E. No holes in tackboards permitted.

3.03 CLEANING

A. Clean tackboard cork and aluminum surfaces in accordance with manufacturer's instructions.

B. Cover tackboard surfaces with protective cover, taped to frame.

C. Remove protective cover at Notice of Completion.

END OF SECTION

SECTION 10 11 25

PEGBOARDS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Pegboards

B. Trim and accessories.

1.02 REFERENCE STANDARDS

A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.

B. ASTM A526 - Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality.

C. ASTM B209 - Aluminum-Alloy Sheet and Plate.

D. ASTM B221 - Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes.

E. ANSI A135.4 - Basic Hardboard.

F. Chapter 8, California Building Code.

1.03 REGULATORY REQUIREMENTS

A. Conform to Table 803.11, California Building Code.

1.04 SUBMITTALS

A. Shop drawings indicating, wall elevations, dimensions and joint locations.

B. Product data on pegboard surface covering, trim and accessories.

C. Three samples illustrating materials and finish, color and texture of pegboard surfacing.

D. Manufacturer's installation instructions.

E. Maintenance information on regular cleaning, stain removal and removal of damaged components.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products of following manufacturers the basis for design and quality intended.

1. Claridge Products and Equipment, Inc., Harrison, AR. Product: MOD6 - Peg Board.
2. Nelson-Adams, Corona, CA.

B. Or equal as approved in accordance with Division 01 General Requirements for substitutions.

2.02 MATERIALS

A. Sheet Steel: ASTM A526, galvanized to G90 designation.

B. Aluminum Sheet: ASTM B209, 6063 alloy, T52 temper.

C. Aluminum Extrusions: ASTM B221, 6061 alloy, temper.

D. Hardboard: ANSI A135.4, tempered, smooth face, perforated.

E. Adhesives: Type recommended by manufacturer. Waterproof type.

2.03 FABRICATION - PEGBOARDS

A. Model: Claridge MOD6 - Peg Board.

B. Series pegboards 1/4 inch natural hardboard with 9/32 inch diameter holes 1 inch centers.

C. Hardboard shall be Class II fire classification, flame spread less than 75, smoke density less than 450.

2.04 FRAME AND TRIM

A. Frame: Extruded aluminum A SERIES, except with galvanized steel or aluminum backing, concealed fasteners:
1. Side Trim: 313T.
2. Mullion Trim: 312T.

2.05 FINISHES

A. Aluminum Frame and Accessories: Anodized to satin finish.

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify that surfaces and internal wall blocking are ready to receive work and dimensions are as indicated on shop drawings.

B. Beginning of installation means acceptance of substrate construction.

3.02 INSTALLATION

A. Install pegboards in accordance with manufacturer's instructions.

B. Establish bottom of perimeter frame at 30 inches above finished floor.

C. Secure units level and plumb.

3.03 CLEANING

A. Clean vinyl and aluminum surfaces in accordance with manufacturer's instructions.

B. Cover pegboard surfaces with protective cover, taped to frame.

C. Remove protective cover at Notice of Completion.

END OF SECTION

SECTION 10 14 00

IDENTIFICATION SIGNS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Plastic Signs, raised character, tactile, room identification, exit door signs, and non-tactile signs.

1.02 REFERENCE STANDARDS

A. Conform to reference standards by date of issue current on date of Contract Documents.

B. American Society for Testing and Materials (ASTM)
   1. ASTM D4802 - Poly (Methyl Methacrylate) Acrylic Plastic Sheet

C. ADA - Americans with Disabilities Act of 1990 as amended.
   1. ADA/Standards - ADA Title II Regulations and the 2010 ADA Standards for Accessible Design.

D. CBC - 2016 California Building Code (CBC)
   1. CBC 16 - Chapter 10, Egress Requirements
   2. CBC 11B - Chapter 11B, Accessibility for Public Buildings, Public Accommodations, Commercial Facilities and Publicly Funded Housing

E. CFC - 2016 California Fire Code.

F. California Code of Regulations (CCR)
   1. CCR 19-3 - Title 19, Chapter 3

G. Fed.Stnd - Federal Standard
   1. Fed.Stnd 595C, Colors Used in Federal Procurement

1.03 SUBMITTALS

A. Shop Drawings of each sign, indicating lettering styles and locations and overall dimensions.

B. Three sample, full size, signs, [with different messages] of types, styles and colors specified including method of mounting. If accepted, samples may be installed in Project.

C. Manufacturer's Installation Instructions

D. Lettering Samples: 1-inch high, uppercase I, and O letters in each font specified, for required Quality Assurance testing.

1.04 QUALITY ASSURANCE

A. Pre-Installation Conference
   1. Notify Architect when signs are ready for installation. Arrange for conference at site. Do not proceed with installation until Architect's approval of specific locations and methods of attachment has been obtained.
   2. Provide signs from one manufacturer, unless otherwise approved.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver products to site and protect from damage. Store until immediately prior to Notice of Completion.

PART 2 - PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Signage and Graphics:
   1. Raised characters shall comply with CBC Section 11B-703.2
      a. Depth: It shall be 1/32-inch minimum above their background and shall be sans serif uppercase and be duplicated in Braille.
      b. Height: It shall be 5/8-inch minimum and 2 inches maximum based on the height of the uppercase letter "I". CBC Section 11B-703.2.5.
      c. Finish and contrast: Characters and their background shall have a non-glare finish. Character shall contrast with their background with either light characters on a dark background or dark characters on a light background. CBC Section 11B-703.5.1
      d. Proportions: It shall be selected from fonts where the width of the uppercase letter "O" is 60% minimum and 110% maximum of the height of the uppercase letter "I". Stroke thickness of the uppercase letter "I" shall be 15% maximum of the height of the character. CBC Section 11B-703.2.4 and 11B-703.2.6.
      e. Character Spacing: Spacing between individual raised characters shall comply with CBC Section 11B-703.2.7 and 11B-703.2.8.
      f. Format: Text shall be in a horizontal format. CBC Section 11B-703.2.9.
      g. Braille: It shall be contracted (Grade 2) and shall comply with CBC Sections 11B-703.3 and 11B-703.4. Braille dots shall have a domed or rounded shape and shall comply with CBC Table and Figure 11B-703.3.1.
      h. Mounting height: Tactile characters on signs shall be located 48" minimum to the baseline of the lowest Braille cells and 60" maximum to the baseline of the highest line of raised characters above the finish floor or ground surface. CBC Section and Figure 11B-703.3.4.1.
      i. Mounting location: A tactile sign shall be located per CBC Section and Figure 11B-703.4.2 as follows:
         1) Alongside a single door at the latch side.
         2) On the inactive leaf at double doors with one active leaf.
         3) To the right of the right hand door at double doors with two active leafs.

4) On the nearest adjacent wall where there is no wall space at the latch side of a single door or at the right side of double doors with two active leafs.
5) So that a clear floor space of 18" x 18" minimum, centered on the tactile characters, is provided beyond the arc of any door swing between the closed position and 45 degree open position.

2. Visual characters shall comply with CBC Section 11B-703.5 and shall be 40" minimum above finish floor or ground.
3. Pictograms shall comply with CBC Section 11B-703.6.
4. Symbols of accessibility shall comply with CBC Section 11B-703.7.
5. Variable message signs shall comply with CBC Section 11B-703.8.

2.02 MANUFACTURERS

A. Products of following manufacturers form basis for design and quality intended.
1. Mohawk Sign Systems, Inc., Schenectady, NY.
2. Roemer Industries, Masury, OH.
3. ASI Modulex, Inc., Dallas, TX.
4. Vomar Products.
5. Apco Signs, Atlanta, GA.
6. Nelson-Harkins Industries, Inc.
7. Mathews International Corporation
8. Vista System

B. Or approved equal in accordance with Division 01 General Requirements for substitutions.

2.03 PLASTIC SIGN MATERIALS

A. Tactile Plastic Sign Materials: Thermosetting high pressure laminate.

B. Non-Tactile Signs: Acrylic Plastic Sheet: ASTM D4802, Category A-1, 1/4 inch overall thickness, laminated acrylic plastic sheets.

2.04 SIGN FABRICATION - GENERAL

A. Plastic Signs
1. Tactile and Braille Copy: **Sand-Carved signs**; thermosetting high pressure laminate using Graphic Process Sand-Carved signs, with square corners, and square cut edges Graphics, Braille and tactile copy required.
a. Unframed Signs: Mohawk 1000 ADA System signs, Series 200A, Design M-311 or Design M310A/B window plaques where indicated, by Mohawk Sign Systems or equal. Custom copy by Architect.
2. Non-tactile Plastic Signs: 1/4 inch overall thickness, laminated acrylic plastic sheets, using sub-surface screen-print process graphics and symbols, exterior-grade at exterior locations, 3/8-inch square corners, square cut edge, drilled holes for countersunk screws, polished edges.
a. Unframed Signs.
3. Apply UV inhibitor overcoat for exterior signs.

B. Fasteners: Stainless steel screws, flat head, pin-in-head torx screws for vandal-proof and clear silicone adhesive.

C. Lettering Type Style: Font to match existing campus and verified by Architect, refer to QUALITY ASSURANCE for letter-proportion compliance.

D. Colors: To match existing campus signs and verified by Architect.

2.05 OCCUPANT LOAD SIGNS

A. Posting of occupant load signage in each room or area use for assembly per CBC 1004.3, CFC & Title 19.

B. Provide maximum occupancy load signs. Post in a conspicuous place near main exits or exit-access doorway of following areas and as indicated on drawings:
1. Assembly rooms.
2. Rooms over occupant load of 50.
3. Classrooms over occupant load of 50.

C. Material:
1. Non-Tactile Signs: Acrylic Plastic Sheet: ASTM D4802, Category A-1.
   a. Overall thickness of 1/4 inch, colors as selected by Architect.
   b. Upper Layer: Non-glare clear acrylic 1/8 inch thick.
   c. Lower Layer: Opaque acrylic, 1/8 inch thick.
   d. Polished edges.

D. Size: 4 inches high by 8 inches, minimum, long, sub-surface application, 7/8 inch high letters, and 1 inch high numbers.
1. Message: MAXIMUM OCCUPANCY LOAD ###
2. Occupant load number as indicated on Drawings.
3. Conform to Sections 1004.3 California Building Code.

2.06 ACCESSIBLE ENTRANCE SIGNS AND PATH OF TRAVEL DIRECTIONAL SIGNS

A. Accessibility Entrance signs: Provide at each accessible building entrance an International Symbol of Accessibility sign, CBC Sections 11B-216.6 and 1007.10 and with additional directional signs, manufacturer's standard, approved by Architect. Sign shall be visible to persons along approaching pedestrian ways.
1. Non-Tactile Signs: Acrylic Plastic Sheet: ASTM D4802 Category A-1.
   a. Upper Layer: Non-glare clear acrylic 1/8 inch thick.
   b. Lower Layer: Opaque acrylic, 1/8 inch thick.
   c. Polished edges.

2.07 TACTILE EXIT SIGNS

A. Conform to Sections 1013.4, 11B.703.1, 11B.703.2, 11B-703.3, 11B.703.4, and 11B.703.5, CBC 2016.

B. Install sign at each exit door as conditions required in CBC Sections 1013.4.

1. Each grade-level exterior exit door that is required to comply with 1013.1 shall be identified by a tactile exit sign with the word, "EXIT".
2. Each exit door that is required to comply with Section 1013.4 and that leads directly to a grade-level exterior exit by means of a stairway or ramp shall be identified by a tactile exit sign with the following words as appropriate:
   a. "EXIT STAIR DOWN"
   b. "EXIT RAMP DOWN"
   c. "EXIT STAIR UP"
   d. "EXIT RAMP UP"
3. Each exit door that is required to comply with Section 1013.1 and that leads directly to a grade-level exterior exit by means of an exit enclosure that does not utilize a stair or ramp, or an exit passageway shall be identified by a tactile exit sign with the words, "EXIT ROUTE".
4. Each exit access door from an interior room or area that is required to comply with Section 1013.1 shall be identified by a tactile exit sign with the words, "EXIT ROUTE".
5. Each exit door through a horizontal exit shall be identified by a tactile exit sign with the words "TO EXIT".

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive Work.

B. Beginning of installation means installer accepts existing surfaces.

3.02 INSTALLATION

A. Install signs only after surfaces are finished, install at all rooms.
   1. At single-leaf doors, locate signs on wall adjacent to latch side of applicable door opening, centered horizontally within 18-inch space adjacent to latch side of door, 60 inches from finish floor to center line of sign. Mounting location shall be located so that a clear space of 18" minimum by minimum by 18" minimum, centered on the tactile characters, is provided beyond the arc of any door swing between the closed position and 45 degree open position. CBC Section 11B-703.4.2.

B. Mounting
   1. Tactile Plastic Signs: Adhesive mounting.
   2. Non-tactile Plastic Signs:
      a. Install with clear silicone adhesive meeting ASTM C834, with zero clearance between plastic and face of substrate. Double face adhesive tape not permitted.

C. For signs installed on glass: a blank vinyl backer is required to be placed on opposite side of glass exactly behind sign being installed. This blank glass back up is to be the same size as sign being installed.

D. Clean and polish signs following manufacturer'¢s instructions.

3.03 FIELD QUALITY CONTROL

A. DSA Inspections: Signs and identifications or other information shall be field inspected after installation and approved by Division of the State Architect prior to the issuance of a final certificate of occupancy, or final approval where no certificate of occupancy is issued. The inspection shall include, but not limited to, verification that Braille dots and cells are properly spaced and the size, proportion and type of raised characters are in compliance with CBC, Section 11B-703.1.1.2.

3.04 SIGN TYPES AND SCHEDULE

A. As indicated on Drawings.

END OF SECTION

SECTION 10 14 23

SIGNS - RESTROOMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Plastic signs at restrooms.

1.02 REFERENCE STANDARDS

A. Conform to reference standards by date of issue current on date of Contract Documents.

B. CBC - 2016 California Building Code
   1. CBC-11 - CBC Chapter 11B, Accessibility for Public Buildings, Public Accommodations, Commercial Facilities and Publicly Funded Housing

C. ADA - Americans with Disabilities Act of 1990 as amended.
   1. ADA/Standards - ADA Title II Regulations and the 2010 ADA Standards for Accessible Design.

D. ASTM D4802 - Poly (Methyl Methacrylate) Acrylic Plastic Sheet.

1.03 SUBMITTALS

A. Shop drawings listing sign styles, lettering and locations and overall dimensions of each sign.

B. Two samples illustrating full size sample sign, of type, style and color specified including method of attachment. If accepted, samples may be installed in project.

C. Letters samples: 1 inch high letters for proportions required in REGULATORY REQUIREMENTS.

1.04 QUALITY ASSURANCE

A. Pre-installation Conference
   1. Notify Architect when signs are ready for installation. Arrange for conference at job site. Do not proceed with installation until Architect's approval of specific locations and methods of attachment has been obtained.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver products to site and protect from damage. Store until immediately prior to Notice of Completion.

PART 2 - PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Tactile Character Type: Tactile characters on signs shall be raised 1/32 inch (0.794 mm) minimum, and shall be sans serif uppercase characters accompanied by Contracted (Grade 2) Braille. Italic, oblique script, highly decorative or unusual style forms not permitted. CBS Section 11B-703.2.

B. Character Proportions: Raised characters on signs shall be selected from fonts where the width of the uppercase letter "O" is 60% minimum and 110% maximum of the height of the uppercase letter "I".

C. Tactile Character Height: Raised characters shall be a minimum of 5/8 inch (15.9 mm) and a maximum of 2 inches (51 mm) high. CBC Section 11B-703.2.5.

D. Stroke thickness of the uppercase letter "I" shall be 15% maximum of the height of the character. CBC Section 11B-703.2.6

E. Character spacing measured between the two closest points of adjacent raised characters within a message. Where characters have rectangular cross sections, spacing shall be 1/8" minimum and 4 times the stroke width, maximum. Where characters have other cross sections, spacing between individual raised characters shall be 1/16" minimum and 4 times the stroke width maximum at the base of the cross sections, and 1/8" minimum and 4 times the stroke width maximum at the top of the cross sections. Characters hall be separated from raised borders and decorative elements 3/8" minimum.

F. Line Spacing: Spacing between the baselines of separate lines of raised characters within a message shall be 135% minimum and 170% maximum of the raised character height.

G. Finish and Contrast: Characters and their background shall have a non-glare finish. Characters shall contrast with their background with either light characters on dark background or dark characters on light background.

H. Braille: California (Contracted) Grade 2 Braille. Dot base diameter shall be 0.059 inch (1.5 mm) to 0.063 inch (1.6 mm). Dots shall be 0.100 inch (2.5 mm) on center in each cell with 0.300 inch (7.6 mm) space between corresponding dots in adjacent cells. Distance between corresponding dots from one cell directly below, 0.395 to 0.400 inch. Dots shall be raised 0.025 to 0.037 inch above the background. Braille dots shall be domed or rounded.

I. Mounting Height and Location: Signs with raised characters and Braille shall be located 48" minimum to the baseline of the lowest line of Braille cells and 60" maximum to the baseline of the highest line of raised characters above the finish floor or ground surfaces. Mounting location shall be located so that a clear space of 18" minimum by minimum by 18" minimum, centered on the tactile characters, is provided beyond the arc of any door swing between the closed position and 45 degree open position. CBC Section 11B-703.4.

2.02 MANUFACTURERS

A. Products of following manufacturers form basis for design and quality intended.
   1. Mohawk Sign Systems, Inc., Schenectady, NY.
   2. Roemer Industries, Masury, OH.
   3. ASI Modulex, Inc., Dallas, TX.
   4. Vomar Products, Inc.
   5. Apco Signs, Atlanta, GA.
   6. Nelson-Harkins Industries, Inc.
   7. Vista System
   8. Diverse Signs Ltd.

2.03 MATERIALS

A. Plastic Signs
   1. Fabrication - General
      a. ADA Tactile and Braille Signs: Sand-Carved signs; thermosetting high pressure laminate using Graphic Process Sand-Carved signs, exterior-grade, graphics, Braille and tactile copy required. Square corners, square cut edges.
         1) Unframed Signs: Model ADA Systems Signs, Series 200A, Design M-311, by Mohawk Sign Systems or equal. Custom copy by Architect.
      b. Non-Tactile Signs: Cast Acrylic Plastic Sheet; ASTM D4802 Category A-1, 1/4 inch overall thickness, laminated acrylic plastic sheets, Sub-surface Screened process graphics and symbols, exterior-grade at exterior locations, square corners, square cut edge, drilled holes for countersunk screws, polished edges.
         1) Unframed Signs.
   2. Finish: Apply UV inhibitor overcoat for exterior signs.

B. Fasteners: Stainless steel screws, flat head, pin-in-head torx screws for vandal-proof and clear silicone adhesive.

C. Lettering Type Style: Helvetica Regular, uppercase letters only, refer to REGULATORY REQUIREMENTS for letter-proportion compliance.

2.04 RESTROOM SIGNAGE

A. Material
   1. ADA Tactile and Braille Signs: Thermosetting high pressure laminate using Graphic Process Sand-Carved signs by Mohawk, Series 200A.
   2. Non-Tactile Signs: Sub-surface, Acrylic Plastic Sheet: ASTM D4802

B. Male Restroom Signage:
   1. Doorways leading to male restrooms shall be identified by equilateral triangle 1/4 inch thick with edges 12 inches long, with vertex pointing upward upon which appears the International Symbol of Accessibility (ISA) in its center, 6 inches high ISA, in contrasting color from door color. Sign shall be mounted in center of door 60 inches from finish floor to center of sign.

2. Room shall be further identified by rectangular room identification sign 1/4 inch thick, 8"H x 6"L minimum unless indicated on Drawings upon which appears a male pictogram 6 inches high, and the word "MEN" immediately below on the same sign in contrasting color. Letters: 5/8 inches min. and 2 inches max. high in contrasting color, raised minimum 1/32 inch fully tactile, accompanied by the California Contracted Grade 2 Braille indicator immediately below. Sign shall be located on wall on latch side of door, 60 inches from finish floor to center of sign, centered horizontally within 18-inch space adjacent to latch side of door or on nearest adjacent wall.
3. Conform to all CBC requirements, CBC 11B.703.1 and 11B-703.7.2.6.1.

C. Female Restroom Signage:
1. Doorways leading to female restrooms shall be identified by circle 1/4 inch thick 12 inches in diameter circle upon which appears the International Symbol of Accessibility (ISA), 6 inches high, in contrasting color from door color. Sign shall be mounted in center of door, 60 inches from finish floor to center of sign.
2. Room shall be further identified by rectangular room identification sign 1/4 inch thick, 8"H x 6"L minimum unless indicated on Drawings upon which appears a female pictogram 6 inches high, and the word "WOMEN" immediately below on the same sign in contrasting color. Letters: 5/8 inches min. and 2 inches max. high in contrasting color, raised minimum 1/32 inch fully tactile, accompanied by the California Contracted Grade 2 Braille indicator immediately below. Sign shall be located on wall on latch side of door, 60 inches from finish floor to center of sign, centered horizontally within 18-inch space adjacent to latch side of door or on nearest adjacent wall.
3. Conform to all CBC requirements, CBC 11B.703.1 and 11B-703.7.2.6.2.

D. Restroom Signage for unisex restroom(s):
1. Doorways leading to unisex restrooms shall be identified by circle 1/4 inch thick, 12 inches in diameter with 1/4 inch thick triangle superimposed on circle and within 12 inch diameter, total 1/2 inch thick upon which appears the International Symbol of Accessibility (ISA), 6 inches high, in contrasting color from door color. Sign shall be mounted in center of door 60 inches from finish floor to center of sign. Color of triangle shall have 70% minimum contrast with color of circle.
2. Room shall be further identified by rectangular room identification sign 1/4 inch thick, 8"H x 6"L minimum unless indicated on Drawings upon which appear a male and female pictograms and the word "RESTROOM" immediately below on the same sign in contrasting color. Letters: 5/8 inches min. and 2 inches max. high in contrasting color, raised minimum 1/32 inch fully tactile, accompanied by California Contracted Grade 2 Braille indicator immediately below, on same sign. The sign shall be located on wall on latch side of door, 60 inches from finish floor to center of sign, centered horizontally within 18 inch space adjacent to latch side of door or on nearest adjacent wall.
3. Conform to all CBC requirement, CBC 11B.703.1 and 11B-703.7.2.6.3.

E. Colors: as indicated on drawings. .

F. Lettering Type Style: Font to match existing campus standard. Refer to drawings, refer to REGULATORY REQUIREMENTS for letter-proportion compliance.

G. Polished edges, all signs.

H. Fabricate sign so that raised letter cannot be peeled off.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive Work.

B. Beginning of installation means installer accepts existing surfaces.

3.02 INSTALLATION

A. Install signs only after surfaces are finished and in all restrooms, in center of door, or on wall adjacent to latch side as specified herein.

B. Mounting
   1. Tactile Plastic Signs: Adhesive mounting.
   2. Non-tactile Plastic Signs:
      a. Install with clear silicone adhesive meeting ASTM C834, with zero clearance between plastic and face of substrate. Double face adhesive tape not permitted.

C. Clean and polish.

3.03 FIELD QUALITY CONTROL

A. DSA Inspections: Signs and identifications or other information shall be field inspected after installation and approved by Division of the State Architect prior to the issuance of a final certificate of occupancy, or final approval where no certificate of occupancy is issued. The inspection shall include, but not limited to, verification that Braille dots and cells are properly spaced and the size, proportion and type of raised characters are in compliance with CBC, Section 11B-703.1.1.2.

END OF SECTION

SECTION 10 28 00

TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Toilet accessories.
   2. Underlavatory guards.

1.02 SUBMITTALS

A. Product Data
   1. Construction details and dimensions.
   2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
   3. Material and finish descriptions.
   4. Features that will be included for Project.
   5. Manufacturer's warranty.

B. Product Schedule: Indicate types, quantities, sizes, and installation locations by room of each accessory required.
   1. Identify locations using room designations indicated.
   2. Identify products using designations indicated.

C. Closeout Submittals
   1. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.03 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.04 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

PART 2 - PRODUCTS

2.01 OWNER-FURNISHED PRODUCTS

A. Refer to specific products below for indication of Owner-furnished, Contractor-Installed (OFCI) or Owner-Furnished, Owner-Installed (OFOI) products.

2.02 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.

B. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch minimum nominal thickness.

C. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.

D. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

E. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

2.03 TOILET ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. American Specialties, Inc., Yonkers, NY.
   2. Bobrick Washroom Equipment, Inc., North Hollywood, CA.
   3. Bradley Corporation, Menomonee Falls, WI.
   4. Or equal, as approved under provisions of Division 01.

B. Paper Towel (Folded) Dispenser:
   1. Basis-of-Design Products:
      a. Surface Mounted:
         1) Bobrick: B-262.
         2) Or approved equal.

C. Liquid Soap Dispenser
   1. Basis-of-Design Products:
      a. Bobrick: B-8221
      b. Or approved equal.

D. Toilet Seat Cover Dispenser
   1. Basis-of-Design Products:
      a. Surface Mounted:
         1) Bobrick: B-221
         2) Or approved equal.

E. Multi-Roll Toilet Tissue Dispenser
   1. Basis-of-Design Products:
      a. Recessed:
         1) Bobrick: B-3888
         2) Or approved equal.

2.04 UNDERLAVATORY GUARDS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Plumberex Specialty Products, Inc.
   2. Truebro by IPS Corporation.
   3. Or equal, as approved under provisions of Division 01.

B. Underlavatory Guard
   1. Description: Insulating pipe covering for supply and drain piping assemblies that prevent direct contact with and burns from piping; allow service access without removing coverings.
   2. Material and Finish: Antimicrobial, molded plastic, white.

2.05 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. 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 REGULATORY REQUIREMENTS

A. Accessories required to be accessible shall be mounted at heights according to CBC Section 11B-603.

B. Accessories shall not be located closer than 1-1/2 inch clear of a tangent point below the grab bar, nor less than 12 inches above the grab bar. CBC Section 11B-609.3.

3.02 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.

3.03 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION

SECTION 10 44 13

FIRE EXTINGUISHERS AND CABINETS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Fire extinguishers and mounting brackets.

B. Cabinets.

1.02 REFERENCE STANDARDS

A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.

B. NFPA 10 - 2012 - Standard for Portable Fire Extinguishers.

C. CFC - California Fire Code 2016, Chapter 9, Section 906 Portable Fire Extinguishers.

D. Title 19, CCR, California Code of Regulations, Public Safety, State Fire Marshal Regulations, Division 1, Chapter 3.

E. UL Underwriters Laboratories Inc., Fire Protection Equipment.

F. ADA - Americans with Disabilities Act of 1990
   1. ADA Standards - ADA Title II Regulations and the 2010 ADA Standards for Accessible Design.

1.03 SUBMITTALS

A. Product data showing physical dimensions, operational features, color and finish, anchorage details, rough-in measurements, location and details.

B. Manufacturer’s installation instructions.

C. Manufacturer’s operation and maintenance data. Include test, refill or recharge schedules, procedures and re-certification including requirements applicable to Work.

1.04 QUALITY ASSURANCE

A. Conform to Title 19-CCR, Division 01, Chapters 1 and 3, and 2016 CFC, Section 906 requirements for extinguishers.

B. Fire extinguishers shall have current certification tag attached.

C. Fire extinguishers must be UL certified.

D. Cabinets shall comply with CBC Chapter 11B, Sections: 11B-307, 11B-308, 11B-309 and 11B-403.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Do not install extinguishers when ambient temperatures may cause freezing.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products of following manufacturers form basis for design and quality intended.
   1. Larsen's Manufacturer's Company, Ft. Lauderdale, FL.
   2. Potter-Roemer, Inc., Santa Ana, CA., UL No. EX 3697.
   3. Amerex Corporation, Los Angeles, CA, UL No. EX 2835.
   4. Ansul Inc., Marinette, WI., UL No. EX 21993
   5. Kidde Mebane, NC., UL No. EX 966.
   6. JL Industries Inc., Bloomington, MN.

B. Or equal as approved in accordance with Division 01, General Requirements for substitutions.

2.02 EXTINGUISHERS

A. ABC Multi-Purpose Dry Chemical:
   1. Red glossy polyester coated steel cylinder with pressure gauge and nozzle.
   2. Size: 5 lbs.
   3. Class: 2A:10B
   4. Positioning: 48 inches max. to handle.
   5. Provide and install hanger bracket accessory at exposed wall-mounted fire extinguisher units. Larsen's Model # 821/862, Potter-Roemer Model # 3903, securing model, or equal.

B. Wet Chemical - Kitchen Use
   1. Title 19 CCR Division 01, Chapter 3 [NFPA 10] UL Rating: 2A:K, Class K Listing.
   2. Size: 2.5 gallons
   3. Stainless steel cylinder with pressure gauge, hose and wand.
   4. Model B262 by AMEREX Corp., Trussville, AL. UL # EX 3759 or equal.
   5. 1 per kitchen, max. travel distance not to exceed 30 feet from hazard to extinguisher.
   6. Standard Bracket

2.03 CABINETS

A. Model: Larsen's - Model: 2409-6R (2-1/2" trim), provide Fire-Rated cabinets at rated assemblies (Larsen's Fire Shield "FS").
   1. Size: To accommodate extinguisher specified herein.
   2. Mounting Style: Semi-Recessed, bottom of cabinet at 32 inches above finished floor, 4 inches maximum projection.
      a. Stainless Steel: No. 304 stainless with No. 4 finish.
   3. Door Style(s):
      a. Duo Vertical Panel with lock.
   4. Glazing:

a. Clear Tempered safety glass.

5. Lettering
   a. Vertical: White

B. Accessibility Type Latching and locking hardware be operable with a single effort by lever type hardware, or other hardware designed so as to not require grasping the opening hardware and not require a force greater than 5 lbs to open.
   1. Force required to activate controls shall not exceed 5 lbs.
   2. Be recessed or semi-recessed in order not to protrude more than 4 inches from face of wall.
   3. Mount so handle of fire extinguisher is 48” maximum AFF.

2.04 FABRICATION OF CABINETS

A. Form body of cabinet with tight inside corners and seams.

B. Pre-drill holes for anchorage.

C. Form perimeter trim and door stiles by welding, filling and grinding smooth.

D. Hinge doors for 180 degree opening with continuous piano hinge.

E. Glaze doors with resilient channel gasket glazing.

F. Pull Handle: U-pull type with roller catch, 5 pounds maximum operating force.

2.05 MOUNTING BRACKETS

A. Manufacturer’s standard steel, designed to secure extinguisher, of sizes required for types and capacities of extinguishers indicated, with plated or baked enamel finish.

B. Provide brackets for extinguishers not located in cabinets sized for units.

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify rough openings for cabinet and mounting brackets are correctly sized and located.

B. Beginning of installation means acceptance of existing conditions.

3.02 INSTALLATION

A. Install cabinets plumb and level in wall openings. Locate cabinets to a height to yield a maximum of 48 inches from finish floor to top of handle of fire extinguisher unit.

B. Mount brackets to a height to yield 48 inches maximum to handle of fire extinguisher where no cabinets are indicated.

C. Secure rigidly in place.

3.03 INSPECTION BY REGULATORY AGENCIES

A. Schedule inspection with agencies and Owner.

B. Furnish approval certificates issued by jurisdictional authorities.

3.04 SCHEDULE: FIRE EXTINGUISHERS AND CABINETS

A. As indicated in drawings: Class 2A:10B:C fire extinguisher and cabinet.

B. Kitchens: One (1), Class K Listing, 2A:K fire extinguishers with specified bracket at each kitchen.

END OF SECTION

SECTION 11 31 00

RESIDENTIAL EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Residential kitchen equipment.

B. Related Sections
1. Division 22, Mechanical: Gas, water, waste and duct connections.
2. Division 26, Electrical: Electrical connections.

1.02 REFERENCE STANDARDS

A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.

B. CBC - California Building Code, 2016.

C. ADA - Americans with Disabilities Act of 1990
1. ADA Standards - ADA Title II Regulations and the 2010 ADA Standards for Accessible Design.

D. SCAQMD - South Coast Air Quality Management District Regulations Rule 1168 Adhesive and Sealant Applications

1.03 SUBMITTALS

A. Product data.

B. Color samples.

C. Meet the applicable requirements of Division 01 General Requirements.
1. Furnish one manufacturer’s extended warranty and one instructions brochure for each appliance furnished.

1.04 QUALITY ASSURANCE

A. Use only skilled workmen who are thoroughly trained and experienced in the necessary crafts.

B. Foodservice equipment required to be accessible shall have hardware that complies with the requirements of CBC Chapter 11B and maneuvering clearance at the exterior side per CBC Section 11B-227 and 11B-904.

C. Food service equipment required to be accessible shall conform to all reach requirements in CBC Figures 11B-16 and 11B-17.

D. Reach Ranges shall comply with CBC Section 11B-308.

E. Regulatory Requirements:
   1. Construction and installation of equipment and related materials shall comply with the California Uniform Retail Food Facilities Law and authorities having jurisdiction.
   2. Electrical appliances, equipment, and materials shall be listed by Underwriters Laboratories, Inc.
   3. Comply with applicable safety, sanitation, and health requirements.

PART 2 - PRODUCTS

2.01 APPLIANCES

A. Acceptable Manufacturers. Products of following manufacturers form basis for design and quality intended.
   1. General Electric
   2. Or equal, approved in accordance with Division 01, General Requirements, for substitutions.

B. See manufacturers and models indicated on Drawings.

2.02 FINISH

A. As indicated on Schedule.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine the substrates and conditions under which work of this section will be performed. Do not proceed until unsatisfactory conditions detrimental to timely and proper completion of the work have been corrected.

3.02 PREPARATION

A. Coordinate the installation of adjoining surfaces and utility rough-ins with the other trades involved.

3.03 INSTALLATION

A. Install equipment in strict accordance with the manufacturer’s installation drawings and instructions, the approved shop drawings, and with applicable codes and regulations

3.04 ADJUSTMENT

A. Upon completion of installation and hook-up of equipment, in the presence of the Owner, put each item through a complete operating cycle. Verify that equipment is properly operating. Verify that trim is in place.

B. Adjust components as necessary to ensure continued proper operation. Remove labels from equipment.

3.05 CLEANING

A. Remove packing debris.

B. Remove all labels and clean interior and exterior surfaces of each appliance.

3.06 SCHEDULE

ITEM	MODEL (General Electric)
A. Electric Convection Oven:	GE 30" JS760SLSS
B. Wall-Mount Hood:	GE 30" UVW8301SLSS with Dimmable LED Lighting
C. Dishwasher:	GE GDF650SMJES

END OF SECTION

SECTION 11 52 14

PROJECTOR MOUNTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Ceiling projector mounts.

B. Accessories

1.02 SUBMITTALS

A. Shop Drawings showing mounting requirements and materials. Shop Drawings shall also include anchor typed and structural calculations by a California Structural Engineer confirming conformance with Section 1613A, California Building Code.

B. Indicate anchorage and accessory items, details signed by licensed Structural Engineer. Costs relating to engineering, calculations, and stamps by Structural Engineer shall be borne by Contractor.
   1. Manufacturer's Installation Instructions: Indicating installation procedures and component installation sequence, clearances and tolerances from adjacent construction and maintenance.

1.03 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop drawings.

1.04 COORDINATION

A. Coordinate the work with ceiling construction.

B. Coordinate with Details.

1.05 REGULATORY REQUIREMENTS

A. Architect will submit drawings and calculations to the Division of State Architect for approval prior to fabrication.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products of the following manufacturer or supplier form the basis for design and quality intended.
   1. Draper Inc., Spiceland, IN.
   2. Chief Manufacturing Company, Savage, NM.
   3. Premier Mounts, Anaheim, CA.
   4. Projectors:

a. Epson

B. Or equal as approved in accordance with Division 01, General Requirements for Substitutions.

2.02 COMPONENTS

A. Product: Premier Mounts Universal Adjustable Projector Mounts: PSD-2446
1. Operation: fixed mounted, adjustable extension tube.
2. Steel construction, finish in neutral color.
3. For projectors max. 75 lbs.
4. Extension arm/Tube: adjust from 24" to 46".
5. Product includes: PSD-PLUS universal projector mount & adjustable height ceiling adapter
6. Projector Mount Specs
a. Tilt +/- 16.5°
b. Pitch +/- 16.5°
c. Yaw +/- 41°

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify site conditions.

B. Verify that ceiling structure are ready to receive work.

3.02 INSTALLATION

A. Install unit assembly in accordance with manufacturer's instructions.

B. Provide electrical, accessories, hook-up for complete operation.

3.03 ERECTION TOLERANCES

A. Maximum Variation of Unit From Plumb: Zero tolerance.

END OF SECTION

SECTION 22 05 03

PIPES AND TUBES FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Pipe and pipe fittings for the following systems:
   1. Domestic water piping within 5 feet of building.
   2. Sanitary sewer piping, within 5 feet of building.
   3. Unions and flanges.
   4. Underground pipe markers.
   5. Bedding and cover materials.

B. Related Sections:
   1. Section 22 05 23 - General-Duty Valves for Plumbing Piping: Product requirements for valves for placement by this section.
   2. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment: Product requirements for pipe hangers and supports [and firestopping] for placement by this section.
   3. Section 22 07 00 - Plumbing Insulation: Product requirements for piping insulation for placement by this section.
   4. Section 23 11 23 - Natural-Gas Distribution: Product and execution requirements for site natural gas distribution systems.

1.02 REFERENCES

A. American Society of Mechanical Engineers:
   1. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.
   2. ASME B16.3 - Malleable Iron Threaded Fittings.
   3. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
   4. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
   5. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings (DWV).
   6. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.
   7. ASME B31.9 - Building Services Piping.
   8. ASME B36.10M - Welded and Seamless Wrought Steel Pipe.
   9. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

B. ASTM International:
   1. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings.
   2. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
   3. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
   4. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.

5. ASTM B32 - Standard Specification for Solder Metal.
6. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes.
7. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
8. ASTM B306 - Standard Specification for Copper Drainage Tube (DWV).
9. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

C. American Welding Society:
1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.
2. AWS D1.1 - Structural Welding Code - Steel.

D. American Water Works Association:
1. AWWA C104 - American National Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
2. AWWA C105 - American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
3. AWWA C110 - American National Standard for Ductile-Iron and Grey-Iron Fittings, 3 in. through 48 in. (75 mm through 1200 mm), for Water and Other Liquids.
4. AWWA C111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
5. AWWA C151 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
6. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in., for Water Distribution.
7. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 in. through 3 in., for Water Service.

E. Cast Iron Soil Pipe Institute:
1. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
2. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

F. National Fire Protection Association:
1. NFPA 13 - Standard for Installation of Sprinkler Systems.

1.03 SUBMITTALS

A. Shop Drawings: Indicate layout of piping systems, including equipment, critical dimensions, and sizes.

B. Product Data: Submit data on pipe materials and fittings. Submit manufacturers catalog information.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.

B. Perform Work in accordance with State and Local Ordinances and Standards.

C. Maintain two copies of each document on site.

1.05 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum three years documented experience.

1.06 PRE-INSTALLATION MEETINGS

A. Division 01 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Division 01 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Furnish temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Protect piping from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.08 ENVIRONMENTAL REQUIREMENTS

A. Division 01 - Product Requirements: Environmental conditions affecting products on site.

B. Do not install underground piping when bedding is wet.

1.09 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.10 COORDINATION

A. Division 01 - Administrative Requirements: Requirements for coordination.

B. Coordinate installation of buried piping with trenching.

PART 2 - PRODUCTS

2.01 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Copper Tubing: ASTM B88, Type K, annealed.
   1. Fittings: ASME B16.18, cast copper, or ASME B16.22, wrought copper.

2. Joints: Compression connection or Brazed, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.

2.02 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Tubing: ASTM B88, Type L, hard drawn.
1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
2. Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F. Braze, AWS A5.8BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.

2.03 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Pipe: CISPI 301, hub-less.
1. Fittings: Cast iron, CISPI 301.
2. Joints: CISPI 310, neoprene gasket and stainless steel clamp and shield assemblies.

2.04 SANITARY SEWER PIPING, ABOVE GRADE

A. Cast Iron Pipe: CISPI 301, hub-less, service weight.
1. Fittings: Cast iron, CISPI 301.
2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

2.05 UNIONS AND FLANGES

A. Unions for Pipe 2 inches and Smaller:
1. Ferrous Piping: Class 150, malleable iron, threaded.
2. Copper Piping: Class 150, bronze unions with soldered.
3. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

B. Flanges for Pipe 2-1/2 inches and Larger:
1. Ferrous Piping: Class 150, forged steel, slip-on flanges.
2. Copper Piping: Class 150, slip-on bronze flanges.
3. Gaskets: 1/16 inch thick preformed neoprene gaskets.

2.06 UNDERGROUND PIPE MARKERS

A. Plastic Ribbon Tape: Bright colored, continuously printed, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

2.07 BEDDING AND COVER MATERIALS

A. Bedding: Fill Type as specified in Division 31.

B. Cover: Fill Type as specified in Division 31.

C. Soil Backfill from Above Pipe to Finish Grade: Soil Type, as specified in Division 31.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Division 01 - Administrative Requirements: Verification of conditions before starting work.

B. Verify excavations are to required grade, dry, and not over-excavated.

C. Verify trenches are ready to receive piping.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

E. INSTALLATION – BURIED PIPING SYSTEMS

F. Verify connection size, location, and invert are as indicated on Drawings. Protect all underground piping from direct soil contact. Contractor to lay-out piping with the appropriate wrapping.

G. Maintain required minimum separation of from other services as required by code.

H. Excavate pipe trench in accordance with Division 31.

I. Install pipe to elevation as indicated on Drawings.

J. Place bedding material at trench bottom to provide uniform bedding for piping, level bedding materials in one continuous layer not exceeding 6 inches compacted depth; compact to 95 percent maximum density.

K. Install pipe on prepared bedding.

L. Route pipe in straight line.

M. Install pipe to allow for expansion and contraction without stressing pipe or joints.

N. Install shutoff and drain valves at locations indicated on Drawings in accordance with this Section and Division 22.

O. Install plastic ribbon tape continuous over top of pipe buried 6 inches below finish grade, above pipe line. Refer to Division 22.

P. Install trace wire continuous over top of pipe buried 6 inches below finish grade, above pipe line. Refer to Division 22.

Q. Pipe Cover and Backfilling:
   1. Backfill trench in accordance with Division 31.
   2. Maintain optimum moisture content of fill material to attain required compaction density.
   3. After hydrostatic test, evenly backfill entire trench width by hand placing backfill material and hand tamping in 6 inches compacted layers to 6 inches minimum cover over top of jacket. Compact to 95 percent maximum density.
   4. Evenly and continuously backfill remaining trench depth in uniform layers with backfill material.
   5. Do not use wheeled or tracked vehicles for tamping.

3.03 INSTALLATION – ABOVE GROUND PIPING

A. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

B. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.

C. Group piping whenever practical at common elevations.

D. Sleeve pipe passing through partitions, walls and floors. Refer to Division 22.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

F. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

G. Provide access where valves and fittings are not accessible. Coordinate size and location of access doors.

H. Install non-conducting dielectric connections wherever jointing dissimilar metals.

I. Establish invert elevations, slopes for drainage to 1/4-inch per foot minimum. Maintain gradients.

J. Slope piping and arrange systems to drain at low points.

K. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

L. Install piping penetrating roof areas to maintain integrity of roof assembly.

M. Install valves in accordance with Section 22 05 23.

N. Insulate piping in accordance with Section 22 07 00.

O. Install pipe identification in accordance with Section 22 05 53.

3.04 INSTALLATION – DOMESTIC WATER PIPING SYSTEMS (LEAD-FREE)

A. Install domestic water piping system in accordance with ASME B31.9.

B. Install domestic water piping system in accordance with Division 22.

C. Install Work in accordance with local plumbing code.

3.05 INSTALLATION – SANITARY WASTE AND VENT PIPING SYSTEM

A. Install sanitary waste and vent piping systems in accordance with ASME B31.9.

B. Install sanitary waste and vent piping systems in accordance with local plumbing code.

C. Install sanitary waste and vent piping systems in accordance with Section 22 13 00.

D. Support cast iron drainage piping at every joint.

E. Install Work in accordance with local plumbing code.

3.06 FIELD QUALITY CONTROL

A. Division 01 - Quality Requirements and Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Test domestic water piping system in accordance with applicable code.

C. Test sanitary waste and vent piping system in accordance with applicable code.

3.07 CLEANING

A. Division 01 - Execution and Closeout Requirements: Requirements for cleaning.

B. Clean and disinfect domestic water distribution system in accordance with Section 22 11 00.

END OF SECTION

SECTION 22 05 13

COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL -

1.01 SUMMARY

A. - Section includes single- and three-phase motors for application on equipment provided under other sections.

B. - Related Sections:
1. - Section 26 05 26 - Grounding and Bonding for Electrical Systems.
2. - Section 26 05 53 - Identification for Electrical Systems.

1.02 REFERENCES

A. - National Electrical Manufacturers Association:
1. - NEMA MG 1 - Motors and Generators.

B. - International Electrical Testing Association:
2. - NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.03 SUBMITTALS

A. - Section 01 30 00 - Submittal Procedures: Requirements for submittals.

B. - Product Data: Submit catalog data for each motor furnished loose. Indicate nameplate data, standard compliance, electrical ratings and characteristics, and physical dimensions, weights, mechanical performance data, and support points.

C. - Test Reports: Indicate procedures and results for specified factory and field testing and inspection.

1.04 QUALIFICATIONS

A. - Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. - Section 01 60 00 - Product Requirements: Product storage and handling requirements.

PART 2 - PRODUCTS

2.01 PRODUCT REQUIREMENTS FOR MOTORS FURNISHED WITH EQUIPMENT

A. - Manufacturers:

1. - Taco.
2. - Bell & Gossett.
3. - Armstrong.

B. - Motors smaller than 3/4 HP: Single-phase motor as specified below.

C. - Single Phase Motors:
1. - Permanent split-capacitor type where available, otherwise use split-phase start/capacitor run or capacitor start/capacitor run motor.
2. - Voltage: 115 volts, single phase, 60 Hz.

D. - Wiring Terminations: Furnish terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated.

PART 3 - EXECUTION

3.01 INSTALLATION

A. - Install securely.

B. - Install engraved plastic nameplates in accordance with Section 26 05 53.

C. - Ground and bond motors in accordance with Section 26 05 26.

3.02 FIELD QUALITY CONTROL

A. - Section 01 40 00 - Quality Requirement: Field inspecting, testing, adjusting, and balancing.

END OF SECTION

SECTION 22 05 23

GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Ball valves.
   2. Plug valves.
   3. Check valves.

B. Related Sections:
   1. Section 22 05 03 - Pipes and Tubes for Plumbing Piping and Equipment: Product and installation requirements for piping materials applying to various system types.
   2. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment: Product and installation requirements for pipe hangers and supports.
   3. Section 22 07 00 - Plumbing Insulation: Product and installation requirements for insulation for valves.
   4. Section 22 11 00 - Facility Water Distribution: Product and installation requirements for piping, piping specialties, and equipment used in domestic water systems.
   5. Section 22 13 00 - Facility Sanitary Sewerage: Product and installation requirements for piping, piping specialties, and equipment used in sanitary waste and vent systems.

1.02 REFERENCES

A. Manufacturers Standardization Society of the Valve and Fittings Industry:
   1. MSS SP 67 - Butterfly Valves.
   2. MSS SP 70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
   3. MSS SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
   4. MSS SP 78 - Cast Iron Plug Valves, Flanged and Threaded Ends.
   5. MSS SP 80 - Bronze Gate, Globe, Angle and Check Valves.
   6. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.03 SUBMITTALS

A. Section 01 30 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturers catalog information with valve data and ratings for each service.

C. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.04 CLOSE SUBMITTALS

A. Section 01 70 00 - Execution Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of valves.

C. Operation and Maintenance Data: Submit installation instructions, spare parts lists, exploded assembly views.

1.05 QUALITY ASSURANCE

A. Maintain one copy of each document on site.

1.06 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum 3 years documented experience approved by manufacturer.

1.07 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary protective coating on cast iron and steel valves.

1.09 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

B. Do not install valves underground when bedding is wet.

1.10 WARRANTY

A. Section 01 70 00 - Execution Requirements: Requirements for warranties.

B. Furnish five year manufacturer warranty for valves excluding packing.

1.11 EXTRA MATERIALS

A. Section 01 70 00 - Execution Requirements: Requirements for extra materials.

B. Furnish two packing kits for each size valve.

PART 2 - PRODUCTS

2.01 BALL VALVES

A. Manufacturers:
1. Red White Valves.
2. Apollo Valves.
3. Milwaukee Valve Company.
4. NIBCO, Inc.

B. 2 inches and Smaller: MSS SP 110, 600 psi WOG two piece bronze body, chrome plated brass ball, full port, teflon seats, blow-out proof stem, solder ends, lever handle.

2.02 CHECK VALVES

A. Horizontal Swing Check Valves:
1. Manufacturers:
a. Red White Valves.
b. Apollo Valves.
c. Hammond Valve
d. Milwaukee Valve Company
e. NIBCO, Inc.
2. 2 inches and Smaller: MSS SP 80, Class 150 bronze body and cap, bronze seat, Buna-N, solder ends.

2.03 PLUG VALVES

A. Manufacturers:
1. DeZurik, Unit of SPX Corp.
2. Flow Control Equipment, Inc.
3. Homestead Valve.

B. 2 inches and Smaller: MSS SP 78, Class 150, semi-steel construction, round port, full pipe area, pressure lubricated, teflon packing, threaded ends.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify piping system is ready for valve installation.

3.02 INSTALLATION

A. Install valves with stems upright or horizontal, not inverted.

B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

C. Install 3/4 inch ball valves with cap for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment.

D. Provide access where valves and fittings are not accessible. Coordinate size and location of access doors with Section 08 31 13.

E. Refer to Section 22 05 29 for pipe hangers

F. Refer to Section 22 07 00 for insulation requirements for valves.

G. Refer to Section 22 05 03 for piping materials applying to various system types.

3.03 VALVE APPLICATION

A. Install shutoff valves at locations indicated on Drawings in accordance with this Section.

B. Install ball valves for shut-off and to isolate equipment or part of systems.

C. Install ball valves for throttling, bypass, or manual flow control services.

END OF SECTION

SECTION 22 05 29

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Pipe hangers and supports.
2. Hanger rods.
3. Inserts.
4. Flashing.
5. Sleeves.
6. Mechanical sleeve seals.
7. Formed steel channel.
8. Firestopping relating to plumbing work.
9. Firestopping accessories.

B. Related Sections:
1. Section 07 92 00 – Joint Protection: Product requirements for sealant materials for placement by this section.
2. Section 22 05 03 - Pipes and Tubes for Plumbing Piping and Equipment: Execution requirements for placement of hangers and supports specified by this section.
3. Section 22 11 00 - Facility Water Distribution: Execution requirements for placement of hangers and supports specified by this section.
4. Section 22 13 00 - Facility Sanitary Sewerage: Execution requirements for placement of hangers and supports specified by this section.
5. Section 22 14 00 - Facility Storm Drainage: Execution requirements for placement of hangers and supports specified by this section.

1.02 REFERENCES

A. American Society of Mechanical Engineers:
1. ASME B31.1 - Power Piping.
2. ASME B31.9 - Building Services Piping.

B. ASTM International:
1. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E119 - Method for Fire Tests of Building Construction and Materials.
3. ASTM E814 - Test Method of Fire Tests of Through Penetration Firestops.
4. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
5. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

C. American Welding Society:
1. AWS D1.1 - Structural Welding Code - Steel.

D. FM Global:
   1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.

E. Manufacturers Standardization Society of the Valve and Fittings Industry:
   1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
   2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
   3. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

F. Underwriters Laboratories Inc.:
   1. UL 263 - Fire Tests of Building Construction and Materials.
   2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
   3. UL 1479 - Fire Tests of Through-Penetration Firestops.
   4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.
   5. UL - Fire Resistance Directory.

G. Intertek Testing Services (Warnock Hersey Listed):
   1. WH - Certification Listings.

1.03 DEFINITIONS

A. Firestopping Through-Penetration Protection System: Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.04 SYSTEM DESCRIPTIONS

A. Firestopping Materials: ASTM E814 to achieve fire ratings as required for adjacent construction.

B. Surface Burning: ASTM E84 with maximum flame spread / smoke developed rating of 25/450.

C. Firestop interruptions to fire rated assemblies, materials, and components.

1.05 PERFORMANCE REQUIREMENTS

A. Firestopping: Conform to applicable code FM fire resistance ratings and surface burning characteristics.

B. Firestopping: Provide certificate of compliance from authority having jurisdiction indicating approval of materials used.

1.06 SUBMITTALS

A. Shop Drawings: Indicate system layout with location including critical dimensions, sizes, and pipe hanger and support locations and detail of trapeze hangers.

B. Product Data:
   1. Hangers and Supports: Submit manufacturers catalog data including load capacity.

2. Firestopping: Submit data on product characteristics, performance and limitation criteria.

C. Firestopping Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.

D. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers. Indicate calculations used to determine load carrying capacity of trapeze, multiple pipe, and riser support hangers. Manufacturer's Installation Instructions:

E. Manufacturer’s Installation
1. Hangers and Supports: Submit special procedures and assembly of components.
2. Firestopping: Submit preparation and installation instructions.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.07 QUALITY ASSURANCE

A. Through Penetration Firestopping of Fire Rated Assemblies: UL 1479 or ASTM E814 with 0.10-inch water gage minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour.
2. Floor and Roof Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.

B. Through Penetration Firestopping of Non-Fire Rated Floor and Roof Assemblies: Materials to resist free passage of flame and products of combustion.
1. Noncombustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of three stories.
2. Penetrating Items: Materials approved by authorities having jurisdiction for penetrating items connecting maximum of two stories.

C. Fire Resistant Joints in Fire Rated Floor, Roof, and Wall Assemblies: ASTM E1966 or UL 2079 to achieve fire resistant rating as indicated on Drawings for assembly in which joint is installed.

D. Fire Resistant Joints between Floor Slabs and Exterior Walls: ASTM E119 with 0.10 inch water gage minimum positive pressure differential to achieve fire resistant rating as indicated on Drawings for floor assembly.

E. Surface Burning Characteristics: 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

F. Perform Work in accordance with applicable authority for welding hanger and support attachments to building structure.

G. Maintain one copy of each document on site.

1.08 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum 3 years documented experience approved by manufacturer.

1.09 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

C. Protect from weather and construction traffic, dirt, water, chemical, and damage, by storing in original packaging.

1.11 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

B. Do not apply firestopping materials when temperature of substrate material and ambient air is below 60 degrees F.

C. Maintain this minimum temperature before, during, and for minimum 3 days after installation of firestopping materials.

1.12 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.13 WARRANTY

A. Section 01 70 00 - Execution Requirements: Product warranties and product bonds.

B. Furnish five year manufacturer warranty for pipe hangers and supports.

PART 2 - PRODUCTS

2.01 PIPE HANGERS AND SUPPORTS

A. Manufacturers:
   1. Carpenter & Paterson Inc.

2. Anvil International
3. B-Line Pipe Hangers and Mechanical Supports
4. National Pipe Hanger Corporation.
5. Substitutions: Section 01 60 00 - Product Requirements.

B. Plumbing Piping - DWV:
1. Conform to ASME B31.9, MSS SP58, MSS SP69 and MSS SP89.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Carbon steel, adjustable swivel, split ring.
3. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
4. Vertical Support: Steel riser clamp.
5. Copper Pipe Support: Copper-plated, carbon-steel adjustable, ring.

C. Plumbing Piping - Water:
1. Conform to ASME B31.9, MSS SP58, MSS SP69 and MSS SP89.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Carbon steel, adjustable swivel, split ring.
3. Hangers for Cold Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
4. Vertical Support: Steel riser clamp.
5. Copper Pipe Support: Copper-plated, Carbon-steel ring.

2.02 ACCESSORIES

A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.03 INSERTS

A. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.04 FLASHING

A. Metal Flashing: 26 gage thick galvanized steel.

B. Metal Counter flashing: 22 gage thick galvanized steel.

C. Lead Flashing:
1. Waterproofing: 5 lb./sq. ft sheet lead.
2. Soundproofing: 1 lb./sq. ft sheet lead.

D. Flexible Flashing: 47 mil thick sheet butyl; compatible with roofing.

E. Caps: Steel, 22 gage minimum; 16 gage at fire resistant elements.

2.05 SLEEVES

A. Sleeves for Pipes through Non-fire Rated Floors: 18 gage thick galvanized steel.

B. Sleeves for Pipes through Non-fire Rated Beams, Walls, and Footings: Steel pipe or 18 gage thick galvanized steel.

C. Sealant: Refer to Section 07 92 00.

2.06 MECHANICAL SLEEVE SEALS

A. Manufacturers:
1. Thunderline Link-Seal, Inc.
2. NMP Corporation
3. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.07 FIRESTOPPING

A. Manufacturers:
1. Dow Corning Corp.
2. Fire Trak Corp.
3. Hilti Corp. Model.

B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.
1. Silicone Firestopping Elastomeric Firestopping: Multiple component silicone elastomeric compound and compatible silicone sealant.
2. Foam Firestopping Compounds: Multiple component foam compound.
3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
4. Fiber Stuffing and Sealant Firestopping: Composite of mineral fiber stuffing insulation with silicone elastomer for smoke stopping.
5. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
6. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
7. Firestop Pillows: Formed mineral fiber pillows.

C. Color: As selected from manufacturer’s full range of colors.

2.08 FIRESTOPPING ACCESSORIES

A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

B. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

C. General:
   1. Furnish UL listed product.
   2. Select products with rating not less than rating of wall or floor being penetrated.

D. Non-Rated Surfaces:
   1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where piping is exposed.
   2. For exterior wall openings below grade, furnish mechanical sealing device to continuously fill annular space between piping and cored opening or water-stop type wall sleeve.

PART 3 - EXECUTION

3.01 EXAMINATIONS

A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify openings are ready to receive sleeves.

C. Verify openings are ready to receive firestopping.

3.02 INSTALLATION - INSERTS

A. Install inserts for suspending hangers from structural framing.

3.03 INSTALLATION – PIPE HANGERS AND SUPPORTS

A. Install in accordance with Structural detail drawings.

B. Support horizontal piping recommended by structural engineer drawings.

C. Install hangers with minimum 1/2-inch space between finished covering and adjacent work.

D. Place hangers within 12 inches of each horizontal elbow.

E. Use hangers with 1-1/2-inch minimum vertical adjustment.

F. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.

G. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.

H. Where piping is installed in parallel and at same elevation, provide multiple pipe hangers.

I. Support riser piping independently of connected horizontal piping.

J. Provide copper plated hangers and supports for copper piping.

K. Design hangers for pipe movement without disengagement of supported pipe.

L. Provide clearance in hangers and from structure and other equipment for installation of insulation.

3.04 INSTALLATION – EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping pads of concrete, minimum 3-1/2 inches thick and extending 6 inches beyond supported equipment. Refer Structural Drawings.

B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.

3.05 INSTALLATION – FLASHING

A. Provide flexible flashing and metal counterflashing where piping penetrates weather or waterproofed walls, floors, and roofs.

B. Flash vent and soil pipes projecting 3 inches minimum above finished roof surface with lead worked 1 inch minimum into hub, 8 inches minimum clear on sides with 24 x 24 inches sheet size.

C. Flash floor drains in floors with topping over finished areas with lead, 10 inches clear on sides with minimum 36 x 36 inch sheet size. Fasten flashing to drain clamp device.

D. Seal floor mop sink drains watertight to adjacent materials.

3.06 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal with mechanical sleeve seals.

B. Set sleeves in position in forms. Provide reinforcing around sleeves.

C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

D. Extend sleeves through floors 2 inch above finished floor level. Caulk sleeves.

E. Where piping penetrates floor, ceiling, or wall, close off space between pipe and adjacent work with firestopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

F. Install chrome plated steel escutcheons at finished surfaces.

3.07 INSTALLATION - FIRESTOPPING

A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping and other items, requiring firestopping.

B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.

C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating to uniform density and texture.

D. Fire Rated Surface:
   1. Seal opening at floor, wall, partition, ceiling, and roof as follows:
      a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
      b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.
      c. Pack void with backing material.
      d. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.

E. Non-Rated Surfaces:
   1. Seal opening through non-fire rated wall, partition floor, ceiling, and roof opening as follows:
      a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
      b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.
      c. Install type of firestopping material recommended by manufacturer.
   2. Exterior wall openings below grade: Assemble rubber links of mechanical sealing device to size of piping and tighten in place, in accordance with manufacturer's instructions.
   3. Interior partitions: Seal pipe penetrations at laboratories, telecommunication rooms, and data rooms. Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit.

3.08 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements, 01 70 00 - Execution Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect installed firestopping for compliance with specifications and submitted schedule.

3.09 CLEANING

A. Section 01 70 00 - Execution Requirements: Requirements for cleaning.

B. Clean adjacent surfaces of firestopping materials.

3.10 PROTECTION OF FINISHED WORK

A. Section 01 70 00 - Execution Requirements: Requirements for protecting finished Work.

B. Protect adjacent surfaces from damage by material installation.

3.11 SCHEDULE

PIPE HANGER SPACING		
PIPE MATERIAL	MAXIMUM HANGER SPACING Feet	HANGER ROD DIAMETER Inches
Cast Iron (All Sizes)	5	5/8
Cast Iron (All Sizes) with 10 foot length of pipe	10	5/8
Copper Tube, 1-1/4 inches and smaller	6	1/2
Copper Tube, 1-1/2 inches and larger	10	1/2
Steel, 3 inches and smaller	12	1/2

END OF SECTION

SECTION 22 05 53

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Nameplates.
   2. Tags.
   3. Pipe markers.

1.02 REFERENCES

A. American Society of Mechanical Engineers:
   1. ASME A13.1 - Scheme for the Identification of Piping Systems.

1.03 SUBMITTALS

A. Section 01 30 00 – Submittal Procedures: Submittal Procedures.

B. Product Data: Submit manufacturers catalog literature for each product required.

C. Shop Drawings: Submit list of wording, symbols, letter size, and color coding for mechanical identification and valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Samples: Submit tags, labels, pipe markers, and, size used on project.

E. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.04 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.

1.05 QUALITY ASSURANCE

A. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

B. Maintain one copy of each document on site.

1.06 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.07 PRE-INSTALLATION MEETING

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.08 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.09 EXTRA MATERIALS

A. Section 01 70 00 - Execution Requirements: Spare parts and maintenance products.

PART 2 - PRODUCTS

2.01 NAMEPLATES

A. Manufacturers:
1. Craftmark Identification Systems.
2. Safety Sign Co.
3. Seton Identification Products.

B. Product Description: Laminated three-layer plastic with engraved black letters on light contrasting background color.

2.02 TAGS

A. Plastic Tags:
1. Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inches diameter.

B. Metal Tags:
1. Brass with stamped letters; tag size minimum 1-1/2 inches diameter with finished edges.

C. Tag Chart: Typewritten letter size list of applied tags and location in anodized aluminum frame.

2.03 PIPE MAKERS

A. Color and Lettering: Conform to ASME A13.1.

B. Plastic Pipe Markers:

1. Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.

C. Plastic Tape Pipe Markers:
1. Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

D. Plastic Underground Pipe Markers:
1. Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

PART 3 - EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

A. Install identifying devices after completion of coverings.

B. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.

C. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.

D. Install tags using corrosion resistant chain. Number tags consecutively by location.

E. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

F. Identify water heaters, pumps, and tanks with plastic nameplates. Identify in-line pumps and other small devices with tags.

G. Identify valves in main and branch piping with tags.

H. Identify piping, concealed or exposed. Use tags on piping 3/4-inch diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

END OF SECTION

SECTION 22 07 00

PLUMBING INSULATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Plumbing piping insulation, jackets and accessories.

1.02 REFERENCE

A. ASTM International:
   1. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
   2. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
   3. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.
   4. ASTM C449/C449M - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
   5. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
   6. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.
   7. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
   8. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
   9. ASTM C585 - Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
   10. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
   11. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
   12. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
   13. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
   14. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.

B. National Fire Protection Association:
   1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

C. Underwriters Laboratories Inc.:
   1. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

1.03 SUBMITTAL

A. Section 01 30 00 – Submittal Procedures: Submittal procedures.

B. Product Data: Submit product description, thermal characteristics and list of materials and thickness for each service, and location.

C. Samples: Submit two samples of representative size illustrating each insulation type.

D. Manufacturer's Installation Instructions: Submit manufacturers published literature indicating proper installation procedures.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.04 QUALITY ASSURANCE

A. Test pipe insulation for maximum flame spread index of 25 and maximum smoke developed index of not exceeding 450 50 in accordance with ASTM E84 and UL 723,

B. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.

C. Factory fabricated fitting covers manufactured in accordance with ASTM C450.

D. Maintain one copy of each document on site.

1.05 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Applicator: Company specializing in performing Work of this section with minimum three years documented.

1.06 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

C. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

1.08 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

B. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.

1.09 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.10 WARRANTY

A. Section 01 70 00 - Execution Requirements: Product warranties and product bonds.

B. Furnish five year manufacturer warranty for man made fiber.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Manufacturers for Glass Fiber and Mineral Fiber Insulation Products:
1. CertainTeed.
2. Knauf.
3. Johns Manville.
4. Owens-Corning.

B. Manufacturers for Closed Cell Elastomeric Insulation Products:
1. Aeroflex. Aerocell.
2. Armacell, LLC. Armaflex.
3. Nomaco. K-flex.

2.02 PIPE INSULATION

A. TYPE P-1: ASTM C547, molded glass fiber pipe insulation.
1. Thermal Conductivity: 0.23 at 75 degrees F.
2. Operating Temperature Range: 0 to 850 degrees F.
3. Vapor Barrier Jacket: ASTM C1136, Type I, factory applied reinforced foil kraft with self-sealing adhesive joints.
4. Jacket Temperature Limit: minus 20 to 150 degrees F.

2.03 PIPE INSULATION JACKETS

A. Vapor Retarder Jacket:
1. ASTM C921, white Kraft paper with glass fiber yarn, bonded to aluminized film.
2. Moisture vapor transmission: ASTM E96; 0.02 perm-inches.

B. PVC Plastic Pipe Jacket:
1. Product Description: ASTM D1784, One piece molded type fitting covers and sheet material, off-white color.

2. Thickness: 10 15 30 mil.
3. Connections: Brush on welding adhesive Tacks Pressure sensitive color matching vinyl tape.

2.04 PIPE INSULATION ACCESSORIES

A. Vapor Retarder Lap Adhesive: Compatible with insulation.

B. Covering Adhesive Mastic: Compatible with insulation.

C. Piping 1-1/2 inches diameter and smaller: Galvanized steel insulation protection shield. MSS SP-69, Type 40. Length: Based on pipe size and insulation thickness.

D. Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement: ASTM C449/C449M.

E. Insulating Cement: ASTM C195; hydraulic setting on mineral wool.

F. Adhesives: Compatible with insulation.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify piping and equipment has been tested before applying insulation materials.

C. Verify surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION – PIPING SYSTEMS

A. Piping Exposed to View in Finished Spaces: Locate insulation and cover seams in least visible locations.

B. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions. Refer to Section 07 84 00 for penetrations of assemblies with fire resistance rating greater than one hour.

C. Piping Systems Conveying Fluids Below Ambient Temperature:
1. Insulate entire system including fittings, valves, unions, flanges, and strainers.
2. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips.
3. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor retarder adhesive or PVC fitting covers.

D. Glass Fiber Board Insulation:

1. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
2. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement.
3. Cover wire mesh or bands with cement to a thickness to remove surface irregularities.

E. Hot Piping Systems less than 140 degrees F:
1. Furnish factory-applied or field-applied standard jackets. Secure with outward clinch expanding staples or pressure sensitive adhesive system on standard factory-applied jacket and butt strips or both.
2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
3. Do not insulate unions and flanges at equipment, but bevel and seal ends of insulation at such locations.

F. Inserts and Shields:
1. Piping 1-1/2 inches Diameter and Smaller: Install galvanized steel shield between pipe hanger and insulation.
2. Piping 2 inches Diameter and Larger: Install insert between support shield and piping and under finish jacket.
   a. Insert Configuration: Minimum 6 inches long, of thickness and contour matching adjoining insulation; may be factory fabricated.
   b. Insert Material: Compression resistant insulating material suitable for planned temperature range and service.

G. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with PVC jacket and fitting covers.

3.03 SCHEDULES

A. Water Supply Services Piping Insulation Schedule:

PIPING SYSTEM	INSULATION TYPE	PIPE SIZE	INSULATION THICKNESS inches
Domestic Hot Water Supply and Recirculation	P-1	2 inches and smaller 2-1/2 inches and larger	1.0 1.5

END OF SECTION

SECTION 22 11 00

FACILITY WATER DISTRIBUTION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Domestic water piping.
2. Unions and flanges.
3. Valves.
4. Thermometers.
5. Relief valves.
6. Strainers.
7. Recessed valve box.
8. Water hammer arrestors.
9. Thermostatic mixing valve.
10. In-line circulator pump.

B. Related Sections:
1. Section 22 05 13 - Common Motor Requirements for Plumbing Equipment: Product requirements for motors for placement by this section.
2. Section 22 05 23 - General-Duty Valves for Plumbing Piping: Product requirements for valves for placement by this section.
3. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment: Product requirements for pipe hangers and supports for placement by this section.
4. Section 22 05 53 - Identification for Plumbing Piping and Equipment: Product requirements for pipe identification and valve tags for placement by this section.
5. Section 22 07 00 - Plumbing Insulation: Product and execution requirements for pipe insulation.

1.02 REFERENCES

A. American National Standards Institute:
1. ANSI Z21.22 - Relief Valves for Hot Water Supply Systems.

B. American Society of Mechanical Engineers:
1. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
2. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
3. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
4. ASME B31.9 - Building Services Piping.
5. ASME B40.1 - Gauges - Pressure Indicating Dial Type - Elastic Element.
6. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.
7. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

C. American Society of Sanitary Engineering:

1. ASSE 1010 - Performance Requirements for Water Hammer Arresters.
2. ASSE 1011 - Performance Requirements for Hose Connection Vacuum Breakers.
3. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers.
4. ASSE 5013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers (RP) and Reduced Pressure Fire Protection Principle Backflow Preventers (RFP).

D. ASTM International:
1. ASTM B32 - Standard Specification for Solder Metal.
2. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes.
3. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
4. ASTM D2846/D2846M - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems.
5. ASTM E1 - Standard Specification for ASTM Thermometers.
6. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers.
7. ASTM F437 - Standard Specification for Threaded Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
8. ASTM F438 - Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40.
9. ASTM F439 - Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
10. ASTM F441/F441M - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.
11. ASTM F442/F442M - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR).
12. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
13. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.

E. American Welding Society:
1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.

F. American Water Works Association:
1. AWWA C151 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
2. AWWA C651 - Disinfecting Water Mains.
3. AWWA C700 - Cold-Water Meters - Displacement Type, Bronze Main Case.
4. AWWA C701 - Cold-Water Meters - Turbine Type, for Customer Service.
5. AWWA C702 - Cold-Water Meters - Compound Type.
6. AWWA C706 - Direct-Reading, Remote-Registration Systems for Cold-Water Meters.
7. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in., for Water Distribution.

G. Manufacturers Standardization Society of the Valve and Fittings Industry:
1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.

2. MSS SP 67 - Butterfly Valves.
3. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
4. MSS SP 80 - Bronze Gate, Globe, Angle and Check Valves.
5. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
6. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

H. National Electrical Manufacturers Association:
1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

I. Plumbing and Drainage Institute:
1. PDI WH201 - Water Hammer Arrester Standard.

J. Underwriters Laboratories Inc.:
1. UL 393 - Indicating Pressure Gauges for Fire-Protection Service.

1.03 SUBMITTALS

A. Section 01 30 00 – Submittal Procedures: Submittal procedures.

B. Product Data:
1. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturer's catalog information.
2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.
3. Hangers and Supports: Submit manufacturers catalog information including load capacity.
4. Domestic Water Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.
5. Pumps: Submit pump type, capacity, certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Submit installation instructions for pumps, valves and accessories.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.04 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of valves and equipment.

C. Operation and Maintenance Data: Submit spare parts list, exploded assembly views and recommended maintenance intervals.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with State and City of Escondido Ordinances and Standards.

B. Maintain one copy of each document on site.

1.06 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.07 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Accept valves and equipment on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.09 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Do not install underground piping when bedding is wet.

1.10 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.11 WARRANTY

A. Section 01 70 00 - Execution Requirements: Product warranties and product bonds.

B. Furnish five year manufacturer warranty for domestic water piping.

1.12 EXTRA MATERIALS

A. Section 01 70 00 - Execution Requirements: Spare parts and maintenance products.

B. Furnish two packing kits for each size valve, two loose keys for outside hose bibs hose end vacuum breakers for hose bibs.

PART 2 - PRODUCTS

2.01 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING (LEAD FREE)

A. Copper Tubing: ASTM B88, Type K, annealed.
   1. Fittings: ASME B16.18, cast copper, or ASME B16.22, wrought copper.
   2. Joints: Compression connection or Brazed, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.

2.02 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Tubing: ASTM B88, Type L, hard drawn.
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
   2. Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F. Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.

2.03 UNIONS AND FLANGES

A. Unions for Pipe 2 inches and Smaller:
   1. Ferrous Piping: Class 150, malleable iron, threaded.
   2. Copper Piping: Class 150, bronze unions with [soldered] [brazed joints].
   3. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

B. Flanges for Pipe 2-1/2 inches and Larger:
   1. Ferrous Piping: Class 150, forged steel, slip-on flanges.
   2. Copper Piping: Class 150, slip-on bronze flanges.
   3. Gaskets: 1/16 inch thick preformed neoprene gaskets.

2.04 BALL VALVES (LEAD FREE)

A. Manufacturers:
   1. Red White Valve Corp.
   2. Milwaukee Valve Company.
   3. NIBCO, Inc.

B. 2 inches and Smaller: MSS SP 110, 600 psi WOG, two piece bronze body, chrome plated brass ball, full port, teflon seats, blow-out proof stem, solder threaded ends, lever handle.

C. 2 inches and larger: MSS SP 110, Class 150 600psi WOG two piece body, type 316 stainless steel ball, full port, teflon seats, blow-out proof stem, solder ends, lever handle.
   1. .

2.05 CHECK VALVES

A. Horizontal Swing Check Valves:
   1. Manufacturers:
      a. Red White Valve Corp.
      b. Milwaukee Valve Company.
      c. NIBCO, Inc. Model.

B. 2 inches and Smaller: MSS SP 80, Class 150, bronze body and cap, bronze seat, Buna-N disc, solder ends.

C. 2-1/2 inches and Larger: MSS SP 71, Class 125, cast iron body, bolted cap, bronze or cast iron disc, renewable disc seal and seat, flanged ends.

2.06 STEM TYPE THERMOMETERS

A. Thermometer: ASTM E1, red appearing mercury, lens front tube, cast aluminum case with enamel finish.
   1. Size: 9 inch scale.
   2. Window: Clear glass.
   3. Stem: Brass, 3-1/2 inch long.
   4. Accuracy: ASTM E77 2 percent.
   5. Calibration: Both degrees F and degrees C.

2.07 WATER PRESSURE REDUCING VALVES

A. 2 inches and Smaller: MSS SP 80, bronze body, stainless steel and thermoplastic internal parts, fabric reinforced diaphragm, strainer, threaded and single union ends.

B. 2 inches and Larger: MSS SP 85, cast iron body, bronze fitted, elastomeric diaphragm and seat disc, flanged.

2.08 RELIEF VALVES

A. Temperature and Pressure Relief:
   1. ANSI Z21.22 certified, bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F, capacity ASME certified and labeled.

2.09 STRAINERS

A. 2 inch and Smaller Class 150, threaded bronze body 300 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.

B. 1-1/2 inch to 4 inch: Class 125, flanged iron body, Y pattern with 1/16-inch stainless steel perforated screen.

2.10 RECESSED VALVE BOX

A. Clothes Washer: Plastic preformed rough-in box with brass valves and center drain outlet, slip in finishing cover.

B. Refrigerator: Plastic preformed rough-in box with brass valve with quarter turn valve, slip in finishing cover.

2.11 WATER HAMMER ARRESTORS

A. ASSE 1010; copper construction, piston type sized in accordance with PDI WH-201.

B. Pre-charged suitable for operation in temperature range 34 to 250 degrees F and maximum 150 psi working pressure.

2.12 THERMOSTATIC MIXING VALVE

A. Water temperature control station: Consisting of a single thermostatic water mixing valve, outlet test connection, balanced return piping and circulator mounted on galvanized strut.

B. Accessories:
1. Volume control shut-off valve on outlet.
2. Dial thermometers.
3. Integral combination check-stops with strainer on inlets.
4. Shut-off valves on water supplies.
5. Aquastat.

C. Rough bronze finish.

2.13 IN-LINE CIRCULATOR PUMP

A. Manufacturers:
1. Taco Pumps.
2. Bell & Gossett.
3. Armstrong Pumps.

B. Casing: Bronze rated for 125 psig working pressure with stainless steel rotor assembly.

C. Impeller: Bronze.

D. Shaft: Alloy steel with integral thrust collar and two, oil lubricated bronze sleeve bearings.

E. Seal: Carbon rotating against stationary ceramic seat.

F. Drive: Flexible coupling.

G. Performance:
1. Refer to Domestic Hot Water Circulating Pump Schedule.

H. Electrical Characteristics and Components:

1. Refer to Domestic Hot Water Circulating Pump Schedule.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt, on inside and outside, before assembly.

3.03 INSTALLATION - THERMOMETERS

A. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inches for installation of thermometer sockets. Allow clearance from insulation.

B. Provide instruments with scale ranges selected according to service with largest appropriate scale.

C. Install thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

3.04 INSTALLATION - HANGERS AND SUPPORTS

A. Install hangers and supports in accordance with Section 22 05 29.

B. Install shutoff and drain valves at locations indicated on Drawings in accordance with this Section.

3.05 INSTALLATION - ABOVE GROUND PIPING

A. Install non-conducting dielectric connections wherever jointing dissimilar metals.

B. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

C. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.

D. Group piping whenever practical at common elevations.

E. Slope piping and arrange systems to drain at low points.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 22 07 00.

H. Provide access where valves and fittings are not accessible.

I. Install domestic water piping in accordance with ASME B31.9.

J. Sleeve pipes passing through partitions, walls and floors. Refer to Section 22 05 29.

K. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping. Refer to Section 22 05 29.

L. Install unions downstream of valves and at equipment connections.

M. Install valves with stems upright or horizontal, not inverted.

N. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

O. Install ball valves for shut-off and to isolate equipment or part of systems.

P. Install ball valves for throttling, bypass, or manual flow control services.

Q. Install water hammer arrestors complete with accessible isolation valve in hot and cold water supply piping to fixtures.

3.06 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Test domestic water piping system in accordance with applicable code and local authority having jurisdiction.

3.07 CLEANING

A. Section 01 70 00 - Execution Requirements: Requirements for cleaning.

B. Disinfect water distribution system.

C. Inject disinfectant, free chlorine in liquid, powder and tablet or gas form, throughout system to obtain residual from 50 to 80 mg/L.

D. Bleed water from outlets to obtain distribution and test for disinfectant residual at minimum 15 percent of outlets.

E. Maintain disinfectant in system for 24 hours.

F. When final disinfectant residual tests less than 25 mg/L, repeat treatment.

G. Flush disinfectant from system until residual concentration is equal to incoming water or 1.0 mg/L.

H. Take samples no sooner than 24 hours after flushing, from 2 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

END OF SECTION

SECTION 22 13 00

FACILITY SANITARY SEWERAGE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. DWV, Sanitary piping above and below grade/floor.
   2. Cleanouts.
   3. Grease interceptor

B. Related Sections:
   1. Section 22 05 03 - Pipes and Tubes for Plumbing Piping and Equipment: Product and installation requirements for piping materials applying to various system types.
   2. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment: Product requirements for pipe hangers and supports [and firestopping] for placement by this section.
   3. Section 22 05 53 - Identification for Plumbing Piping and Equipment: Product requirements for pipe identification for placement by this section.

1.02 REFERENCES

A. American Society of Mechanical Engineers:
   1. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.
   2. ASME A112.14.3 - Grease Interceptors.
   3. ASME A112.14.4 - Grease Removal Devices.
   4. ASME B16.3 - Malleable Iron Threaded Fittings.
   5. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings (DWV).
   6. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.
   7. ASME B31.9 - Building Services Piping.

B. ASTM International:
   1. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings.
   2. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
   3. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
   4. ASTM B32 - Standard Specification for Solder Metal.
   5. ASTM B302 - Standard Specification for Threadless Copper Pipe.
   6. ASTM B306 - Standard Specification for Copper Drainage Tube (DWV).
   7. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

C. Cast Iron Soil Pipe Institute:

1. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
2. CISPI 310 - Specification for Coupling for Use in Connections with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

D. Manufacturers Standardization Society of the Valve and Fittings Industry:
1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
3. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

E. Plumbing and Drainage Institute:
1. PDI G101 – Standard – Testing and Rating Procedure for Grease Interceptors.

1.03 SUBMITTALS

A. Section 01 30 00 – Submittal Procedures: Submittal procedures.

B. Product Data:
1. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturers catalog information.
2. Hangers and Supports: Submit manufacturers catalog information including load capacity.
3. Sanitary Drainage Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.

C. Manufacturer's Installation Instructions: Submit installation instructions for material and equipment.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.04 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of equipment and clean-outs.

1.05 QUALITY ASSURANCE

A. Maintain one copy of each document on site.

1.06 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.07 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.09 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Do not install underground piping when bedding is wet or frozen.

1.10 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.11 WARRANTY

A. Section 01 70 00 - Execution Requirements: Product warranties and product bonds.

1.12 EXTRA MATERIALS

A. Section 01 70 00 - Execution Requirements: Spare parts and maintenance products.

PART 2 - PRODUCTS

2.01 SANITARY SEWER PIPING

A. Cast Iron Pipe: CISPI 301, hub-less.
   1. Fittings: Cast iron, CISPI 301.
   2. Joints: CISPI 310, neoprene gasket and stainless steel clamp and shield assemblies.

2.02 UNIONS AND FLANGES

A. Unions for Pipe 2 inches and Smaller:
   1. Copper Piping: Class 150, bronze unions with [soldered] [brazed joints].
   2. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

B. Flanges for Pipe 2-1/2 inches and Larger:
   1. Copper Piping: Class 150, slip-on bronze flanges.
   2. Gaskets: 1/16-inch thick preformed neoprene gaskets.

2.03 CLEANOUTS

A. Exterior Surfaced Areas: Round cast nickel bronze access frame and non-skid cover.

B. Exterior Unsurfaced Areas: Line type with lacquered cast iron body and round epoxy coated cover with gasket.

C. Interior Finished Floor Areas: Galvanized cast iron body with anchor flange, threaded top assembly, and round scored cover with gasket in service areas and square depressed cover with gasket to accept floor finish in finished floor areas.

2.04 GREASE INTERCEPTORS

A. Comply with ASME A112.14.3.

B. Construction:
   1. Material: Polyethylene.
   2. Rough in: Below grade installation.

C. Accessories: Field adjustable riser system, built-in flow control, built-in test caps and H20 load rated cast iron covers.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.03 INSTALLATION - HANGERS AND SUPPORTS

A. Inserts:
   1. Provide inserts for suspending hangers from structural framing.

B. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.9 and MSS SP 89.
   2. Support horizontal piping as scheduled.
   3. Install hangers to provide minimum ½-inch space between finished covering and adjacent work.
   4. Place hangers within 12 inches of each horizontal elbow.

5. Use hangers with 1-1/2-inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
6. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
7. Where installing several pipes in parallel and at same elevation, provide multiple pipe hangers.
8. Provide copper plated hangers and supports for copper piping.

3.04 INSTALLATION - BURIED PIPING SYSTEMS

A. Verify connection size, location, and invert are as indicated on Drawings.

B. Establish elevations of buried piping with not less than 2 feet of cover.

C. Establish minimum separation of piping in accordance with CPC code.

D. Remove scale and dirt on inside of piping before assembly.

E. Place bedding material at trench bottom to provide uniform bedding for piping, level bedding materials in one continuous layer not exceeding 4 inches compacted depth; compact to 95 percent maximum density.

F. Install pipe on prepared bedding.

G. Route pipe in straight line.

H. Install plastic ribbon tape continuous over top of pipe.

3.05 INSTALLATION - ABOVE GROUND PIPING

A. Slopes for drainage to 1/4 inch per foot minimum. Maintain gradients.

B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Provide clearances at cleanout for snaking drainage system.

C. Encase exterior cleanouts in concrete flush with grade.

D. Install floor cleanouts at elevation to accommodate finished floor.

E. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

F. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

G. Install piping to maintain headroom. Do not spread piping, conserve space.

H. Group piping whenever practical at common elevations.

I. Install piping to allow for expansion and contraction without stressing pipe or joints.

J. Install piping penetrating roof areas to maintain integrity of roof assembly.

K. Sleeve pipes passing through partitions, walls and floors.

L. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping.

3.06

PIPE HANGER SPACING		
PIPE MATERIAL	MAXIMUM HANGER SPACING Feet	HANGER ROD DIAMETER Inches
Cast Iron (All Sizes)	5	5/8
Cast Iron (All Sizes) with 10 foot length of pipe	10	5/8
Copper Tube, 1-1/4 inches and smaller	6	1/2
Copper Tube, 1-1/2 inches and larger	10	1/2

END OF SECTION

SECTION 22 40 00

PLUMBING FIXTURES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Sinks.

B. Related Sections:
   1. Section 07 92 00 – Joint Protection: Product requirements for caulking between fixtures and building components for placement by this section.
   2. Section 22 11 00 - Facility Water Distribution: Supply connections to plumbing fixtures.
   3. Section 22 13 00 - Facility Sanitary Sewerage: Waste connections to plumbing fixtures.

1.02 REFERENCES

A. American National Standards Institute:
   1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.

B. American Society of Mechanical Engineers:
   1. ASME A112.18.1 - Plumbing Fixture Fittings.
   2. ASME A112.19.3 - Stainless Steel Plumbing Fixtures (Designed for Residential Use).

1.03 SUBMITTALS

A. Section 01 30 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

C. Manufacturer's Installation Instructions: Submit installation methods and procedures.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.04 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution Requirements: Closeout procedures.

B. Operation and Maintenance Data: Submit fixture, trim, exploded view and replacement parts lists.

1.05 QUALITY ASSURANCE

A. Provide products requiring electrical connections listed and classified by Underwriters Laboratories Inc., as suitable for purpose specified and indicated.

B. Maintain one copy of each document on site.

1.06 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.07 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Accept fixtures on site in factory packaging. Inspect for damage.

C. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.09 WARRANTY

A. Section 01 70 00 - Execution Requirements: Product warranties and product bonds.

B. Furnish five year manufacturer warranty for plumbing fixtures.

1.10 EXTRA MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer uniformity of materials and equipment shall be the standard catalogued products of manufacturers regularly engaged in production of such fixtures or equipment, and shall be the latest standard designs that comply with the specification requirements.

B. Subject to compliance with requirements, provide products by the following:
   1. Stainless Steel Sinks:
      a. Just Mfg. Co.
      b. Or approved equal.
   2. Faucets:
      a. Chicago Faucet
      b. Or approved equal

2.02 PLUMBING FIXTURES

A. Plumbing fixture trim shall be brass with polished chromium plated finish unless otherwise specified.

B. Fixtures shall comply with state water conservation requirements and local code compliance.

C. Refer to Plumbing Fixture Schedule on drawings for plumbing fixture to be provided and installed.

2.03 INSULATION KIT

A. Product Description: Where sinks are noted to be ADA compliance, furnish the following: Safety Covers conforming to ANSI A177.1 and consisting of insulation kit of molded closed cell vinyl construction, 3/16-inch thick, white color, for insulating tailpiece, P-trap, valves, and supply piping. Furnish with weep hole and angle valve access covers.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify walls and floor finishes are prepared and ready for installation of fixtures.

C. Verify electric power is available and of correct characteristics.

D. Confirm millwork is constructed with adequate provision for installation of counter top lavatories and sinks.

3.02 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule.

3.03 INSTALLATION

A. Install each fixture with trap, easily removable for servicing and cleaning.

B. Provide chrome plated flexible supplies to fixtures with loose key stops, reducers, and escutcheons.

C. Install components level and plumb.

D. Install and secure fixtures in place with wall carriers and bolts.

E. For ADA accessible sinks with garbage disposals shall be punched with the drain opening offset to the back.

F. For ADA accessible sinks provide offset grid drain where required such as not to encroach on required ADA knee space.

3.04 INTERFACE WITH OTHER PRODUCTS

A. Review millwork shop-drawings. Confirm location and size of fixtures and openings before rough in and installation.

3.05 ADJUSTING

A. Section 01 70 00 - Execution Requirements: Testing, adjusting, and balancing.

B. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.06 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Clean plumbing fixtures and equipment.

3.07 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 70 00 - Execution Requirements: Protecting installed construction.

B. Do not permit use of fixtures before final acceptance.

END OF SECTION

SECTION 23 05 00

COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.01 DESCRIPTION

A. General provision:
   1. This Division is an integrated whole comprising interrelated and interdependent sections and shall be considered in its entirety in determining requirements.
   2. Applies to all Work and requirements of Divisions 21, 22 and 23.

B. Provide a complete and operable installation, including all labor, supervision, materials, equipment, tools, apparatus, transportation, warehousing, rigging, scaffolding and other equipment and services necessary to accomplish the work in accordance with the intent and meaning of these drawings and specifications.

C. Related work specified elsewhere:
   1. Concrete work, except as otherwise specified: Division 3.
   2. Motor starters and disconnect switches, wiring and conduit, except as otherwise specified: Division 26.
   3. Painting, except as otherwise specified: Division 9.
   4. Installation of access doors and plaster frames for registers and grilles: Division 8.
   5. Temperature control wiring, except as otherwise specified herein: Division 26.

D. This Section includes general administrative and procedural requirements for mechanical installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 1.
   1. Submittals
   2. Coordination drawings
   3. Record Documents
   4. Maintenance manuals
   5. Rough-ins
   6. Mechanical installations
   7. Cutting and Patching

1.02 DEFINITIONS (AS USED ON DIVISION 21, 22 AND 23 DRAWINGS AND HEREIN)

A. “Provide” means furnish, install and connect unless otherwise described in specific instances.

B. “Piping” means pipes, fittings, valves and all like pipe accessories connected thereto.

C. “Ductwork” means ducts, plenums, compartments, or casings including the building structure, which are used to convey or contain air.

D. “Extend”, “Submit”, “Repair” and similar words mean that the Contractor (or his designated subcontractor) shall accomplish the action described.

E. “Codes” or “Code” means all codes, laws, statutes, rules, regulations, ordinances, orders, decrees, and other requirements of all legally constituted authorities and public utility franchise holders having jurisdiction.

F. “Products”, “Materials” and “Equipment” are used interchangeably and mean materials, fixtures, equipment, accessories, etc.

G. “Utility Areas” are defined as mechanical, electrical, janitorial, and similar rooms or spaces which are normally used or occupied only by custodial or maintenance personnel. “Public Areas” are defined as the rooms or spaces that are not included in the utility areas definition.

H. “Building Boundary” includes concrete walkways immediately adjacent to the building structure.

I. “Below Grade” means buried in the ground.

J. “Substantial Mechanical Completion” means all components of all systems are functioning but lacking in final adjustment.

K. “Pressure Rating Specified” (such as for valves and the like) mean design working pressure for and with references to the fluid which the device will serve.

1.03 QUALITY ASSURANCE

A. Regulations and standards: (Current Edition unless otherwise noted)

AABC	Associated Air Balance Council
ADC	Air Diffuser Council, Test Code
AGA	American Gas Association
AMCA	Air Moving and Conditioning Association
ANSI	American National Standards Institute
ARI	Air Conditioning and Refrigeration Institute
ASA	American Standards Association
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASSE	American Society of Sanitary Engineers
ASTM	American Society for Testing and Materials

AWWA	American Water Works Association
CCR	California Code of Regulation
CBC	California Building Code
CEC	California Electric Code
CMC	California Mechanical Code
CPC	California Plumbing Code
CTI	Cooling Tower Institute
CS	Commercial Standards - U.S. Department of Commerce
CISPI	Cast Iron Soil Pipe Institute
FMS	Factory Mutual System
FIA	Factory Insurance Association
HI	Hydraulic Institute Standards
IAPMO	International Association of Plumbing and Mechanical Officials
IRI	Industrial Risk Insurance Companies
ISA	Instrument Society of America
MSS	Manufacturers Standardization Society
NCWB	National Certified Pipe Welding Bureau
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NEBB	National Environmental Balancing Bureau
OSHA	Occupation Safety and Health Act
PDI	Plumbing and Drainage Institute
SAMA	Scientific Apparatus Makers Association
SHEMA	Steam Heating, Equipment Manufacturers Association
SMACNA	Sheet Metal and Air Conditioning Contractors National Association, Inc.
SCAQMD	Southern California Air Quality Management Division

UL Underwriters Laboratories, Inc.

B. Requirements of regulatory agencies: Nothing in the Drawings and Specifications shall be construed to permit work not conforming to applicable laws, ordinances, rules and regulations. In the event of a conflict with local ordinances and statutes, the local requirements shall take precedence over the specified standards and codes. When drawings and specifications exceed requirements of applicable laws, ordinances, rules and regulations, the Drawings and Specifications take precedence. It shall be the Contractor's responsibility to correct, at no cost to the Owner, any work he executes in violation of Code requirements. Specific references to codes elsewhere in this Division are either to aid the Contractor in locating applicable information or to deny him permission to use options that are permitted by codes.

C. Permits and inspections charges:
   1. Refer to the General Conditions of the Contract.
   2. Obtain schedule and pay for permits, licenses, approvals, tests, inspection and certificate of final inspection required by legally constituted authorities and public utility franchise holders having jurisdiction over the work.
   3. Afford the Owner's representative every facility for evaluating the skill and competence of the mechanics and to examine the materials. Concealed work shall be reopened when so directed during the periodic visits.

1.04 PROJECT CONDITIONS

A. Verifying Job Conditions: Examine all drawings and specifications in a manner to be fully cognizant to all work required under this Division. Adjoining work of other trades shall be examined for interferences and conditions affecting the work of this Division.

B. Visit site prior to bidding and investigate the existing conditions that affects and will be affected by the work of this Division. Become familiar with the working conditions and take into account any special or unusual features peculiar to these jobs. By the act of submitting the bid, the contractor will be deemed to have complied with the foregoing, to have accepted such conditions as could be reasonably determined at the time, and to have made allowance therefor in preparing his bid.

C. The locations of existing utility lines are shown in accordance with reference data received by the Architect. The points of connection are therefore approximate and the Bidder shall include in his bid adequate funds to cover cost of connection regardless of their exact location.

D. Exercise extreme caution during trenching operations. Repair the damage caused by such operations to existing utility lines at no cost to the Owner provided the lines could have been reasonably identified.

1.05 DRAWINGS

A. The Contract Drawings indicate the general arrangement of piping, ductwork and equipment.
   1. For the purpose of clarity and legibility, drawings are essentially diagrammatic to the extent that many offsets, bends and special fittings and exact locations of

items are not specifically dimensioned. Diagrammatic drawings shall be understood as schemes of required systems.

2. Drawings and specifications are intended to complement each other. Where conflicts exist between the drawings and/or specifications, the contractor shall request clarification.
3. Certain runs of piping or ductwork may be shown distorted to avoid confusion. However, systems shall be grouped into orderly function and relationship, consistent with code requirements and working space.
4. Exact routing of systems, locations of fixtures, grilles, thermostats and devices shall be governed by structural conditions and obstructions. Ceiling installed devices shall be located symmetrically with respect to room centerline, lighting fixtures and type of ceiling system. Architectural restraints shall be verified before roughing-in.
5. Building and room dimensions, location of doors, partitions and similar physical features shall be taken from the Architectural Drawings at the approximate location shown on the Mechanical Drawings.
6. Manufacturers' drawings and instructions shall be followed in all cases and will become the basis for inspecting and accepting or rejecting actual installation procedures utilized in the performance of the work. Where manufacturer's instructions are in conflict with local codes or governing ordinances, the Engineer shall be notified for determination.
7. Mechanical drawings are generally diagrammatic, and do not indicate necessary offsets, obstructions, or structural conditions required for coordination with other trades. The contractor shall be responsible for the correct placing of his work and the proper location and connection of his work in relation with work of other trades.
8. It is the responsibility of the Contractor to install the work in such a manner that it will conform to the structure, avoid obstructions, and maintain headroom.
9. Items above are to be performed at no additional cost to the Owner.
10. Manufacturer's drawings and instructions, when not in conflict with governing codes, shall be followed in all cases where the makers of devices and equipment furnish directions or details not shown on the Drawings or described in the Specifications.
11. Drawings are not intended to be scaled, but shall be followed with sufficient accuracy to coordinate with other work and structural limitations.
12. Work installed in a manner contrary to that shown on the drawings shall be removed and reinstated when so directed by the Engineer. Discrepancies and questionable points shall be immediately reported to the Engineer for clarification.

B. Modification of Contract Drawings:

1. In the event that substitute materials or equipment will require, for proper installation, changes to the design as indicated on the Contract Drawings, appropriate proposed revision drawings in an approved format shall be submitted for review. Such drawings shall be sufficiently complete for the proper installation of the proposed substitute materials or equipment and for construction by all interested trades of the proposed revisions to the Contract Documents.
2. The cost of the drawings, cost of drawing checking, and approval by all legally constituted authorities having jurisdiction shall be borne by the Contractor. All

such drawings shall be made a part of the record documents as specified in Division 1.

C. All provisions shall be deemed mandatory except as expressly indicated as optional by the work “may” or “option”.

D. Contractor shall verify, at the site, the location of all existing equipment, ductwork, piping, utilities, panel boards and partitions affecting the installation of new work.

1.06 INSTALLATION OF THE WORK

A. Installation of mechanical work shall be coordinated with the Project Construction Schedule. The contractor shall be totally responsible for coordinating the layout of all building elements to avoid conflict of the work of the structural, mechanical, electrical systems, and architectural features of the building. The cost of any extra work of any kind caused by a conflict due to this lack of coordination shall be borne by the Contractor.
   1. Before proceeding with the work, the Contractor shall examine all Contract Documents, check and verify all dimensions and sizes that may affect the fitting of his materials and equipment to other parts of the equipment, structure and work of other Divisions.
   2. Work installed which interferes with the work of other trades shall be removed and reinstalled at the Contractor's expense when so directed by the Engineer.
   3. It shall be understood that no extras to the Contract will be permitted to accomplish the above results.
   4. Notify the Engineer of points of conflict between the work and that of other trades so that the conflict may be properly adjusted.
   5. Coordinate mechanical systems, equipment, and materials installation with other building components.
   6. Verify all dimensions by field measurements.
   7. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for mechanical installations.
   8. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
   9. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
   10. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
   11. Coordinate connection of mechanical system with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
   12. Install systems, materials, and equipment to conform to approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements refer conflict to the Engineer.

13. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
14. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components, where installed exposed in finished spaces.
15. Install access panel or doors where units are concealed behind finished surfaces.
16. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specific slope.

B. Coordinate field details with other trades to avoid construction delays and maintain required clearances.
1. Equipment bases and supports: Furnish certified details and drawings for approval before fabrication. Furnish all parts necessary for each base, sub-base and support.
2. Pipe sleeves and inserts: Furnish and install all pipe sleeves and pipe support inserts before concrete is poured.
3. Roof, wall and floor openings: Furnish shop drawings showing exact locations and sizes of openings through roofs, walls and floors.
4. When changes in size of equipment bases and pads result in additional design and construction costs, such costs shall be borne by Contractor.
5. Moving of equipment: Investigate each space through which equipment must be moved. Where necessary, equipment shall be shipped from manufacturer in crated sections of size suitable for moving through restricted spaces available.

C. Prepare coordination drawings in accordance with Division 1 to a scale of 1/4” = 1’-0” or larger; detailing major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination for the installations are of importance to the efficient flow of the work, including but not necessarily limited to the following:
1. Indicate the proposed locations of piping, ductwork, equipment, and materials. Include the following:
    a. Clearances for installing and maintaining insulation.
    b. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.
    c. Equipment for connections and support details.
    d. Exterior wall and foundation penetrations.
    e. Fire-rated wall and floor penetrations.
    f. Sizes and location of required concrete pads and bases.
    g. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
    h. Prepare reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communication systems components, sprinklers, and other ceiling mounted items.
    i. No extras will be allowed for changes made necessary by interference with work of other trades. Areas of limited clearance shall be laid out to

3/4" = 1'-0" scale with all ducts, pipes, conduits, beams, etc., shown and shall be signed by the General Contractor's superintendent on the job.

D. Examine other Divisions for work related to the work of this Division, especially Division 26.

E. Rough-In
   1. Verify final locations of rough-ins with field measurements and with the requirements of the actual equipment to be connected.
   2. Refer to equipment specifications in Divisions 22 and 23 for rough-in requirements.

F. Delivery and Storage:
   1. All material shall be delivered to the site with all labels intact and identified to permit check against approved material lists and for shop drawings. Lost or damaged materials and equipment will be replaced by new at no increase in contract cost. Damaged factory applied finishes supplied with final finish under this Division shall be refinished as approved by the Engineer, employing workmen skilled in the work involved. Finishing materials shall be obtained from the equipment or materials manufacturer.
   2. Protect materials against dirt, water, chemical and mechanical damage both while storage and during construction.

1.07 OPENINGS, CUTTING AND PATCHING

A. Openings have been indicated on the Architectural and Structural Drawings, additional openings or holes required for the work of this Division and cost of such work is an obligation to this Division.
   1. Openings, cutting and patching to be in accordance with that specified under Division 1, 7 and 8.
   2. At a time in advance of the work, verify the openings indicated on Architectural and Structural Drawings. If the work of this Division requires such, furnish new instructions as to requirements for these openings, subject to approval by the Engineer.

B. Additional cutting and patching and reinforcement of construction of building, required under the work of this Division, subject to approval by the Engineer, to be performed under the Division of the Specification covering the particular materials, and the cost of same shall be an obligation to this Division.

C. Core drilling of floor slabs and concrete walls for passage of pipes, where authorized by the Engineer, shall be provided under the work of this Division.

1.08 CORROSION PROTECTION

A. All below ground metallic fittings, valves, flanges, bolts, shall be protected against corrosion as follows:
   1. All metallic components as described above shall receive a heavy coating of "Henry's" or "Marvin" or equal oil base roof mastic.
   2. After mastic coating is completed and inspected, wrap entire metallic component with a minimum of 8 mil polyethylene wrap overlapped 50% of the

circumference and extended beyond ends of component as required for polyethylene to be secured to piping. The overlap seam shall be located to avoid backfill material from entering the encapsulated area. The ends of the seam of the polyethylene material shall be secured to the piping and sealed with 3M Scotch or Calpico/Wrap No. 50 or equal, 10 mil, 2 inch wide, printed, pipe wrap and sealing tape.

3. The mastic coating shall be inspected and approved prior to finish application of the polyethylene material, which shall also be inspected.

1.09 PROJECT RECORD DOCUMENTS

A. Drawings of Record: The Contractor shall provide and keep up-to-date a complete record set of blue line prints. These shall be from the original drawings. This set of prints shall be kept on the job site, and shall be used only as a record set. This shall not be construed as authorization for the Contractor to make changes in the layout without definite instruction in each case.

B. The actual size, location and elevation of all buried lines, valve boxes, manholes, monuments, and stub outs shall be accurately located and dimensioned from building walls or other permanent landmarks.

C. Changes: Clearly and correctly mark Record Drawings to show all changes made during the construction process at the time the changed work is installed. No such changes shall be made in the work unless authorized by a Modification or by a specific approval of deviations or revisions in submittals.

D. Upon completion of the work, a set of reproducible drawings marked as “As-Builts” and a compact disk containing electronic files of the drawings in current version of AutoCAD shall be submitted to the Engineer for approval. After approval, asp-built drawings and the electronic file shall be turned over to the Owner’s Representative.

1.10 STANDARDS

A. Compliance shall be in conformance with the requirements of Division 1. Submit proof of material and equipment conformance to the requirements of Regulations and Standards. The label or listing of the specified agency will be acceptable evidence. In lieu of the label or listing, the Contractor may submit a written certificate from an approved, nationally recognized testing organization, adequately equipped and competent to perform such services, verifying that the items have been tested and that the work conforms to the Regulations and Standards, including the methods of testing utilized by the testing agency.

1.11 MATERIALS AND EQUIPMENT

A. Compliance shall be in conformance with the requirements of Division 1.
   1. Provide products by manufacturers regularly engaged in the manufacture of similar items with an acceptable history of successful production and ability to render competent and thorough technical services and spare parts through local organizations.
   2. Provide the names and addresses of the nearest service and maintenance organization and spare parts supplier.

3. Discontinued models will not be accepted by the Owner even if that model was specified. The Engineer must be immediately notified if there is a conflict in this matter.
4. Materials and equipment shall be new, current models of manufacturers and bear complete identification by the manufacturers.
5. Materials and equipment shall be guaranteed by the manufacturer to equal or exceed specified, submitted and published ratings. Equipment specified by manufacturer's number shall include all accessories, controls and devices listed in manufacturers catalog as standard with the equipment.
6. Provide a complete working installation with all equipment called for in proper operating conditions. Drawings and Specifications do not undertake to list every item or device of equipment to be installed. When an item or device is necessary for the operation of the equipment shown or specified, the items or devices shall be provided with the equipment that will allow the system to function properly.

1.12 CLOSING-IN OF UN-INSPECTED WORK

A. Contractor shall not allow or cause any of the work to be covered up or enclosed until it has been inspected, tested and approved by the Engineer. Should any of his work be covered up or enclosed before such inspection and test, he shall, at his own expense, uncover the work and after it has been inspected, tested and approved, make all repairs with such materials as may be necessary to restore all his work and that of other trades to its original and proper condition.

1.13 EQUIPMENT SUPPORTS

A. Furnish and install necessary steel supports and seismic restraints for fans, coils, receivers, tanks, piping and other equipment for a complete installation and as approved by the Engineer. Supports shall be painted with one coat of rust-preventative paint after installation under work of this Division.

1.14 BUILDING FOOTING CLEARANCES

A. Under no circumstances shall pipes, ducts or conduits be run through footings. They shall cross below footings or through sleeves above footings. Those running parallel to footings shall have the minimum clearances from the cone of influence indicated on the Structural Drawings or as required by Code.

1.15 DAMAGE BY LEAKS

A. Contractor shall be responsible for all damage to any part of the premises caused by rain leaks through or around ducts or pipes, leaks or breaks in piping, equipment or fixtures furnished and/or installed by him for a period of 1 year from the date of acceptance of the work by the Owner.

1.16 ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT

A. All motors, power driven equipment and automatic control equipment, except motor starters as hereinafter set forth required and connected with the work of this section of the specifications are to be furnished and installed under Division 21, 22, and 23.

B. Control low (24V) and control line (120V) voltage wiring, conduit and related switches and relays required for the automatic control and/or interlock of motors and equipment including final connection, are to be furnished and installed under Division 21, 22 and 23. Materials and installation to conform to Class 1 or 2, CCR Title 24, Article E725, and as restricted under the Division 26 of these specifications.

C. Power wiring, conduit, outlets, disconnect switches motor starter and motor-rated contactors, and making of final connections, except as hereinafter specified, are to be furnished and installed under the Division 25, 26, 27 and 28 of the specification.

D. Identify circuits and equipment as outlined in the Electrical section of these specifications.

E. Coordinate requirements for underground conduit only between buildings for control interlocks shown on the drawings. This conduit is to be furnished and installed under Division 26 of these specifications.

1.17 SUPPLEMENTARY FRAMING

A. Provide supplementary framing required for attachment of hanger, supports and anchors. Fasten supplementary framing to structure in an approved manner. Supplementary framing of structural angle iron, channels and "I" beams properly designed to carry the weight of piping and its contents and to withstand any thrust exerted by the expansion or contraction of the piping.

B. Submit details of hangers, anchors, supplementary framing including the proposed method of fastening of supplementary framing to the base building structure and calculations used in determining the proposed fastening method.

C. Structural work shall conform to applicable building codes.

D. Paint supplementary framing with one coat of rust preventive paint after installation of work under this Division.

1.18 STARTERS, DISCONNECTS AND WIRING

A. Starters and disconnects will be provided under Division 26, except for special equipment which is specified with the equipment.

B. All line voltage control wiring and all conduits for both line voltage and low voltage control wiring shall be provided under Division 26, except as specified under Division 21, 22 and 23 and/or specified herein.

1.19 ADDITIONAL BALANCING DEVICES

A. Provide any additional apparatus, devices or equipment that may be required to completely balance all the air and hydronic systems. Such apparatus, devices or equipment shall be included in the work at no additional cost to the Owner.

1.20 DELIVERY, HANDLING, STORAGE OF MATERIALS, PROTECTION OF WORK

A. Properly store, adequately protect, and carefully handle equipment and materials to prevent damage before and during installation as recommended by the manufacturer and as approved by the Engineer. Items determined to be damaged or defective shall be repaired or replaced as determined by the Engineer at no cost to the Owner. Determinations of the Engineer shall be final.

B. Protect materials against dirt, water, chemical and mechanical damage both while in storage and during construction.

C. Cover materials in such a manner that no finished surfaces will be damaged, marred or splattered with plaster or paint, and all moving parts will be kept clean and dry.

D. Replace or refinish any damaged materials including fronts of control panels, ductwork fittings, and shop-fabricated ductwork.

E. Keep cabinets and other openings closed to prevent entry of foreign matter.

F. Refer to other sections of this Division for additional requirements.

1.21 STANDARD PRODUCTS

A. Materials and equipment shall be essentially the standard catalogued products of manufacturers regularly engaged in production of such materials or equipment, and shall be their latest standard designs that comply with the specification requirements. Materials and equipment shall duplicate items that have been in satisfactory commercial of industrial use at least two years prior to bid opening. Where two units of the same class of equipment are required, these units shall be products of a single manufacturer. The components thereof, however, are not required to be exclusively of the same manufacturer. Each major component of equipment shall have manufacturer's name, address, model and serial number on a nameplate securely affixed in a conspicuous place. The nameplate of the distributing agent will not be acceptable.

1.22 SAFETY REQUIREMENTS

A. Belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts located so that any person can come in close proximity thereto shall be fully enclosed or properly guarded. High temperature equipment and piping so located as to endanger personnel or create a fire hazard shall be properly guarded or covered with insulation of a type specified herein. Provide items such as catwalks, ladders, and guard rails where required for safe operation and maintenance of equipment.

1.23 MANUFACTURER'S RECOMMENDATIONS

A. Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material or equipment being installed, furnish printed copies of these recommendations to the Engineer prior to installation. Installation of the item will not be allowed to proceed until the recommendations are

received. Failure to furnish these recommendations can be cause for rejection of the material.

1.24 OPERATION AND MAINTENANCE MANUAL:

A. Furnish an operation and maintenance manual covering the stipulated mechanical systems and equipment. Seven copies of the manual, bound in the hardback binders or an approved equivalent, shall be provided to the Owner and one copy to the Engineer. Furnish one complete manual prior to the time that system or equipment tests are performed. Furnish the remaining manuals before the contract is completed. The following identification shall be inscribed on the cover:
   1. Operations and Maintenance Manual
   2. Building Number
   3. Contractor
   4. Contract Number

B. Provide a table of contents. Insert tab sheets to identify discrete subjects. Instruction sheets shall be legible and easily understood, with large sheets of drawings folded in. The manual shall be complete in all respects for all equipment, controls, accessories and appurtenances stipulated. Include as a minimum the following:
   1. System layout showing piping, valves and controls.
   2. Wiring and control diagrams with data to explain detailed operation and control of each component.
   3. A control sequence describing start-up, operation and shutdown.
   4. Detailed description of the function of each principal component of the system.
   5. Procedure for starting.
   6. Procedure for operating.
   7. Shutdown instructions.
   8. Installation instructions.
   9. Adjustments, maintenance and overhaul instructions.
   10. Lubrication schedule including type grade, temperature range and frequency.
   11. Safety precautions, diagrams and illustration.
   12. Test procedures.
   13. Performance data.
   14. Parts lists with manufacturer's names and catalog numbers.
   15. Preventive maintenance schedule.
   16. Service organization with name, address and telephone number.
   17. Valve identification chart and schedule.
   18. ASME certificates.
   19. Air balance report.
   20. Hydronic balance report.

C. Provide operation and maintenance manuals for all mechanical and electrical equipment. Furnish four (4) complete sets.

1.25 INSTRUCTIONS TO OWNER PERSONNEL

A. When specified in other sections or herein, the Contractor shall furnish, without additional expense to the Owner, the services of competent instructors who will give full instruction to the designated personnel in the adjustments, operation, and maintenance, including pertinent safety requirements, of the equipment or system

specified. Each instructor shall be thoroughly familiar with all parts of the installation, and shall be trained in operating theory as well as practical operation and maintenance work. Instruction shall be given during the first regular work week after the equipment or system has been accepted and turned over to the Owner for regular operation. The number of man-days of instruction is specified; approximately half of the time shall be for classroom instruction. All other time shall be used for instruction with the equipment or system. When significant changes or modifications in the equipment or system are made under the terms of the contract, provide additional instruction to acquaint the operating personnel with the changes or modifications.

B. The following systems and equipment shall be required to be furnished with operating instructions:
   1. Hot water system, man-day (8 hours).
   2. Air handling system, man-day (8 hours).
   3. Miscellaneous exhaust equipment and systems, man-day (3 hours per system).

1.26 BUILDING OCCUPANCY VENTILATION

A. Prior to move in by the occupants, the building or area shall have a minimum period of two weeks with their systems running on full exhaust and 100% outside air 24 hours a day to completely off-gas the furnishings.

B. The total ventilation of the area shall be scheduled with the Engineer.

1.27 SPARE PARTS AND TOOLS

A. Contractor shall furnish difficult-to-obtain manufacturer unique spare parts upon contract completion.

B. Contractor shall furnish any special tools required to service equipment with the equipment. Provide a lockable metal toolbox to secure tools.

1.28 WARRANTY

A. In addition to requirements of the Conditions of the Contract, warrant all equipment, ratings, capacities, motor HP, etc., to produce the specified and indicated performance at an elevation of the project site above sea level.
   1. Refer to individual equipment specifications for warranty requirements.
   2. Where periods more than one year are specified in the specifications, such longer periods shall govern. However, when any component fails at any time during this period, the warranty period for such component and all other components which are inactive because of said failure shall be suspended. The warranty period for such components shall resume to run for the remaining portion of this warranty period when failed components are completely repaired and in operation; however, in no case shall the resumed portion of the warranty period be less than 3 months in duration.
   3. Compile and assemble the warranties specified in Division 21, 22, and 23, into a separated set of vinyl covered, three ring binders, tabulated and indexed for easy reference.
   4. Provide complete warranty information for each item to include product or equipment to include date of beginning of warranty or bond; duration of warranty

or bond; and names and addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.

1.29 OWNER EXISTING SYSTEM OPERATION

A. The premises and the existing building will be in use at the time the work of this contract is in progress. The contractor shall conduct his work so as to cause no inconvenience or danger to the personnel on the premises.

B. The contractor shall maintain continuity of services to the existing HVAC system, domestic water system, and sanitary sewer system, except for designated intervals which connections can be made. The scheduling of shutdown period shall be at the time directed by the Engineer.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.01 INSTALLATION

A. Workmanship shall be in the best standard practice of the trade.

B. Install equipment in accordance with the manufacturer's instructions and recommendations unless otherwise noted or specified.

C. Sequence, coordinate and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements:
   1. Coordinate mechanical systems, equipment, and materials installation with other building components.
   2. Verify all dimensions by field measurements.
   3. Arrange for chases, slots and openings in other building components during progress of construction, to allow for mechanical installation.
   4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
   5. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the work. Give particular attention to large equipment requiring positioning prior to closing in the building.
   6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
   7. Coordinate connection of mechanical system with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
   8. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the work are shown only in diagrammatic form. Where coordination

requirements conflict with individual system requirements, refer conflict to the Engineer.

9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
10. Install mechanical equipment to facilitate servicing, maintenance and repair or replacement of equipment components, where installed exposed in finished spaces.
11. Install access panel or doors where units are concealed behind finished surfaces.
12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specific slope.

3.02 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

B. Refer to equipment specifications in Division 22 and 23 for rough-in requirements.

3.03 CUTTING AND PATCHING

A. Perform cutting and patching in accordance with Division 1.

B. In addition to the requirements specified in Division 1, the following requirements apply: Protection of Installed Work: During cutting and patching of operations, protect adjacent installations.

C. Perform cutting, fitting, and patching of mechanical equipment and materials required to:
1. Remove and replace defective work.
2. Remove and replace work not conforming to requirements of the contract documents
3. Remove samples of installed work as specified for testing.
4. Install equipment and materials in existing structures.
5. Upon written instructions from the Engineer, uncover and restore work to provide for Engineer observation of concealed work.

D. Cut, remove and legally dispose of selected mechanical equipment, components, and materials as indicated, including but not limited to removal of mechanical piping, heating units, plumbing fixtures and trim, and other mechanical items made obsolete by the new work.

E. Protect the structure, furnishings, finishes and adjacent materials not indicated or scheduled to be removed.

F. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

G. Patch existing finished surfaces and building components using new materials matching existing materials and experienced installers. Installer’s qualifications refer to

the materials and methods required for the surface and building components being patched. Refer to Division 1, for definition of “Experienced Installer”.

3.04 SYSTEM OPERATIONAL TESTS

A. The Contractor shall inform the Owner one week prior to starting this testing in order that the Owner’s Representative may be present.

B. After balancing and prior to final inspection, the contractor shall operate all systems continuously trouble free and stable for a minimum period of fourteen consecutive days including Saturday and Sunday. Each day shall be a 24 hour day for buildings with 24 hour operation and an 8 hour day for buildings with 8 hour and less operating schedules. Should a problem arise, the 14 day period shall be restarted and repeated until successfully operated for a full 14 days. A written report certified by the Owner’s Representative shall indicate the successful completion of a stable and trouble free 14 day period.

3.05 CLEANING

A. Cleaning shall be done as the work proceeds. Periodically remove waste and debris to keep the site as clean as is practical.

B. Refer to Division 1 for general requirements for final cleaning.

C. Leave exposed parts of the mechanical work in a neat, clean and usable condition, with painted surfaces unblemished and plated metal surfaces polished.

D. Thoroughly clean all materials, equipment and appliances. Clean and prepare all surfaces to be painted. Clean the entire premises of unused materials, debris, spots and marks to the satisfaction of the Engineer.

E. Remove, thoroughly clean and replace all strainers and automatic valves after the system has been put in operation until system is clear of all foreign matter and repeat this operation after 10 days and again after the system has been in operation 30 days. Submit certification that this operation has been completed.

END OF SECTION

SECTION 23 05 29

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Pipe hangers and supports.
2. Hanger rods.
3. Inserts.
4. Flashing.
5. Equipment curbs.
6. Sleeves.
7. Mechanical sleeve seals.
8. Formed steel channel.

B. Related Sections:
1. Section 09 90 00 – Painting and Coating: Product and execution requirements for painting specified by this section.

1.02 REFERENCES

A. American Society of Mechanical Engineers:
1. ASME B31.1 - Power Piping.
2. ASME B31.5 - Refrigeration Piping.
3. ASME B31.9 - Building Services Piping.

B. ASTM International:
1. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E119 - Method for Fire Tests of Building Construction and Materials.
3. ASTM E814 - Test Method of Fire Tests of Through Penetration Firestops.
4. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
5. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

C. American Welding Society:
1. AWS D1.1 - Structural Welding Code - Steel.

D. FM Global:
1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.

E. Manufacturers Standardization Society of the Valve and Fittings Industry:
1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
3. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

F. Underwriters Laboratories Inc.:
   1. UL 263 - Fire Tests of Building Construction and Materials.
   2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
   3. UL 1479 - Fire Tests of Through-Penetration Firestops.
   4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.
   5. UL - Fire Resistance Directory.

G. Intertek Testing Services (Warnock Hersey Listed):
   1. WH - Certification Listings.

1.03 DEFINITIONS

A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.04 SUBMITTALS

A. Refer to Section 01 30 00 Submittals, for submittal requirements.

B. Shop Drawings: Indicate system layout with location including critical dimensions, sizes, and pipe hanger and support locations and detail of trapeze hangers.

C. Product Data:
   1. Hangers and Supports: Submit manufacturers catalog data including load capacity.

D. Firestopping Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.

E. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers. Indicate calculations used to determine load carrying capacity of trapeze, multiple pipe, and riser support hangers.

F. Manufacturer's Installation Instructions:
   1. Hangers and Supports: Submit special procedures and assembly of components.
   2. Firestopping: Submit preparation and installation instructions.

G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with applicable authority and AWS D1.1 for welding hanger and support attachments to building structure.

1.06 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

B. Protect from weather and construction traffic, dirt, water, chemical, and damage, by storing in original packaging.

1.08 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.09 WARRANTY

A. Coordinate warranty with Division 1.

PART 2 - PRODUCTS

2.01 PIPE HANGERS AND SUPPORTS

A. Manufacturers:
1. Fee and Mason Manufacturing Co.
2. ITT Grinnell Corp
3. B-Line Systems, Inc.
4. Carpenter & Paterson Inc.
5. Creative Systems Inc.
6. Flex-Weld Inc.
7. Globe Pipe Hanger Products
8. Michigan Hanger Co.
9. Superior Valve Co.
10. Or equal.

2.02 ACCESSORIES

A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.03 INSERTS

A. Mechanical Expansion Anchors: Insert wedge-type, zinc coated, except exterior or corrosive environment shall be stainless steel, for use in hardened Portland cement concrete with pullout, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Hilti, Inc.
2. ITW Ramset/Red Head
3. Powers Fasteners
4. Or equal.

B. Cast in Place Deck Insert: Embedded Hanger Strap, sized per SMACNA “HVAC Duct Construction Standards – Metal and Flexible” Table 4-1.
1. Tolco Fig 109A (metal deck).
2. Simpson “Blue Banger”
3. Grinnell Fig 282 (concrete floor)
4. B-Line Fig. B3019 (metal deck)
5. Or equal.

C. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.04 FLASHING

A. Metal Flashing: 26 gage thick galvanized steel.

B. Metal Counterflashing: 22 gage thick galvanized steel.

C. Lead Flashing:
1. Waterproofing: 5 lb/sq. ft sheet lead.
2. Soundproofing: 1 lb/sq. ft sheet lead.

D. Flexible Flashing: 47 mil thick sheet butyl; compatible with roofing.

E. Caps: Steel, 22 gage minimum; 16 gage at fire resistant elements.

2.05 EQUIPMENT CURBS

A. Fabrication: Welded 18 gage galvanized steel shell and base, mitered 3 inch cant, variable step to match root insulation, 1-1/2 inch thick insulation, factory installed wood nailer.

2.06 SLEEVES

A. Sleeves for Pipes through Non-fire Rated Floors: 18 gage thick galvanized steel.

B. Sleeves for Pipes through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.

C. Sleeves for Round Ductwork: Galvanized steel.

D. Sleeves for Rectangular Ductwork: Galvanized steel or wood.

E. Sealant: Acrylic; refer to Division 07.

2.07 MECHANICAL SLEEVE SEALS

A. Manufacturers:
1. Thunderline Link-Seal, Inc.
2. NMP Corporation
3. Or equal.

B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.08 FORMED STEEL CHANNEL

A. Manufacturers:
1. Allied Tube & Conduit Corp.
2. B-Line Systems
3. Unistrut Corp.
4. Midland Ross Corp.
5. Or equal.

B. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

2.09 FIRESTOPPING

A. Manufacturers:
1. Dow Corning Corp.
2. Hilti Corp.
3. 3M Fire Protection Products
4. Fire Trak Corp.
5. International Protective Coating Corp.
6. Specified Technology, Inc.
7. Or equal.

B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.

C. Shall comply with the requirements of Division 7.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify openings are ready to receive sleeves.

C. Verify openings are ready to receive firestopping.

3.02 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

B. Remove incompatible materials affecting bond.

C. Powder-actuated anchors are not allowed.

D. Install backing or damming materials to arrest liquid material leakage.

E. Do not drill or cut structural members.

F. Obtain permission from Engineer before drilling or cutting structural members.

3.03 INSTALLATION - INSERTS

A. Install inserts for placement in concrete forms.

B. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.

D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

E. Where inserts are omitted, or in existing structure, drill through concrete slab from below and provide expansion anchors approved by structural engineer.

3.04 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Install in accordance with ASME B31.1, ASME B31.5, ASME 31.9, ASTM F708, MSS SP 58, MSS SP 69 and MSS SP 89.

B. Support horizontal piping as scheduled.

C. Install hangers with minimum 1/2 inch space between finished covering and adjacent work.

D. Place hangers within 12 inches of each horizontal elbow.

E. Use hangers with 1-1/2 inch minimum vertical adjustment.

F. Support vertical piping at every floor.

G. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.

H. Support riser piping independently of connected horizontal piping.

I. Provide copper plated hangers and supports for copper piping.

J. Design hangers for pipe movement without disengagement of supported pipe.

K. Prime coat exposed steel hangers and supports. Refer to Division 09. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

L. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Division 22.

3.05 INSTALLATION - FLASHING

A. Provide flexible flashing and metal Counterflashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.

B. Provide curbs for roof installations 14 inches minimum high above roofing surface. Flash and counter-flash with sheet metal; seal watertight. Attach counterflashing to equipment and lap base flashing on roof curbs. Flatten and solder joints.

C. Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

3.06 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal with mechanical sleeve seals.

B. Set sleeves in position in forms. Provide reinforcing around sleeves.

C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

D. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.

E. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with stuffing or firestopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

F. Install stainless steel escutcheons at finished surfaces.

3.07 INSTALLATION - FIRESTOPPING

A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, and other items, requiring firestopping.

B. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating and as recommended by the manufacturer’s instruction.

C. Fire Rated Surface:
   1. Seal opening at floor, wall, partition, ceiling, and roof as follows:
   2. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
   3. Size sleeve allowing minimum of 1 inch void between sleeve and building element.

4. Pack void with backing material.
5. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.
6. Where cable tray, bus, cable bus, conduit, wireway, trough, and penetrates fire rated surface, install firestopping product in accordance with manufacturer's instructions.

D. Non-Rated Surfaces:
1. Seal opening through non-fire rated wall, partition, floor, ceiling, and roof opening as follows:
2. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
3. Size sleeve allowing minimum of 1 inch void between sleeve and building element.
4. Install type of firestopping material recommended by manufacturer.
5. Install escutcheons, floor plates or ceiling plates where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.
6. Exterior wall openings below grade: Assemble rubber links of mechanical sealing device to size of piping and tighten in place, in accordance with manufacturer's instructions.
7. Interior partitions: Seal pipe penetrations at clean rooms, laboratories, hospital spaces, computer rooms, telecommunication rooms and data rooms. Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit.

3.08 FIELD QUALITY CONTROL

A. Inspect installed firestopping for compliance with specifications and submitted schedule.

3.09 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.10 PROTECTION OF FINISHED WORK

A. Protect adjacent surfaces from damage by material installation.

3.11 SCHEDULES

A. Copper and Steel Pipe Hanger Spacing:

PIPE SIZE Inches	COPPER TUBING MAXIMUM HANGER SPACING Feet	STEEL PIPE MAXIMUM HANGER SPACING Feet	COPPER TUBING HANGER ROD DIAMETER Inches	STEEL PIPE HANGER ROD DIAMETER Inches
1/2	6	7	3/8	3/8
3/4	6	7	3/8	3/8
1	6	7	3/8	3/8
1-1/4	6	7	3/8	3/8
1-1/2	6	10	3/8	3/8
2	6	10	3/8	3/8
2-1/2	9	10	1/2	1/2
3	10	10	1/2	1/2
4	10	10	1/2	5/8
5	10	10	1/2	5/8
6	10	10	5/8	3/4
8	10	10	3/4	3/4

B. Refer to manufacturer’s recommendations for grooved end piping systems.

C. Note 1: Provide hanger at each change of direction and each branch connection. For pipe sizes 6 inches and smaller, subjected to loadings other than weight of pipe and contents.

D. Note 2: Provide hanger at each change of direction and each branch connection. For pipe sizes 6 inches and smaller, subjected to loadings other than weight of pipe and contents.

END OF SECTION

SECTION 23 05 53

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. - Section Includes:
1. - Painted Identification Materials
2. - Plastic Tape
3. - Plastic Duct Markers
4. - Diagram and Schedule Frames
5. - Engraved Plastic Laminate Signs
6. - Plastic Equipment Markers
7. - Plasticized Tags
8. - Ceiling Tacks
9. - Lockout devices.

B. - Related Sections:
1. - Section 09 90 00 - Painting: Execution requirements for painting as specified by this section.

1.02 REFERENCES

A. - American Society of Mechanical Engineers:
1. - ASME A13.1 - Scheme for the Identification of Piping Systems.

1.03 SUBMITTALS

A. - Section 01 30 00 Submittal Procedures: Submittal procedures.

B. - Product Data: Submit manufacturers catalog literature for each product required.

C. - Shop Drawings: Submit list of wording, symbols, letter size, and color coding for mechanical identification and valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. - Samples: Submit two tags, labels and pipe markers size used on project.

E. - Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

F. - Manufacturer's Certificate: Certify products meet or exceed specified requirements.

G. - Acceptance or no exceptions taken by the engineer on any substitution proposed by the contractor shall not be construed as relieving the contractor from compliance with the project's specifications and performance requirements nor departure there from. The contractor remains responsible for details and accuracy for confirming and correlating quantities and dimensions and for the selection of fabrication processes,

techniques and assembly, coordination of his work with that of all other trades and making any needed modifications consequent to the substitution at his own cost and for performing the work in a safe manner.

1.04 CLOSEOUT SUBMITTALS

A. - Section 01 70 00 - Execution Requirements: Closeout procedures.

B. - Schedules and Diagrams:
1. - Submit valve schedule for each piping system, typewritten and reproduced on 8-1/2" x 11" bond paper. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification. Mark valves which are intended for emergency shut-off and similar special uses, by special "flags", in margin of schedule.
2. - Submit temperature control diagrams and Sequence of Operation on bond paper suitable for framing.

C. - Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.

1.05 QUALITY ASSURANCE

A. - Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

B. - Maintain one copy of each document on site.

1.06 QUALIFICATIONS

A. - Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. - Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.07 PRE-INSTALLATION MEETINGS

A. - Division 01 - Administrative Requirements: Pre-installation meeting.

B. - Convene minimum one weeks prior to commencing work of this section.

1.08 FIELD MEASUREMENTS

A. - Verify field measurements prior to fabrication.

1.09 EXTRA MATERIALS

A. Section 01 70 00 - Execution Requirements: Spare parts and maintenance products.

PART 2 - PRODUCTS

1.10 ACCEPTABLE MANUFACTURERS

A. - Manufacturers:
1. Craftmark Identification Systems
2. Brady (W.H.) Co.; Signmark Div.
3. Industrial Safety Supply Co., Inc.
4. Seaton Identification Products
5. Safety Sign Co.
6. Substitutions: Division 01 - Product Requirements

1.11 NAMEPLATES

A. - Product Description: Laminated three-layer plastic with engraved black letters on light contrasting background color.

1.12 MECHANICAL IDENTIFICATION MATERIALS

A. - General: Provide manufacturer's standard products of categories and types required for each application as referenced in other Division 21, 22 and 23 sections. Where more than single type is specified for application, selection is installer's option but provide single selection for each product category.

1.13 PLASTIC DUCT MARKERS

A. - General: Provide manufacturer's standard laminated plastic, color-coded duct markers. Conform to the following color code:
1. Green: Cold air
2. Yellow: Hot air
3. Yellow/Green: Supply air
4. Blue: Exhaust, outside, return, and mixed air
5. For hazardous exhausts use colors and designs recommended by ANSI A13.1.

B. - Nomenclature: Include the following:
1. Direction of airflow.
2. Duct service (supply, return, exhaust, etc.)

1.14 PLASTIC TAPE

A. - General: Provide manufacturer's standard color-coded pressure sensitive (self-adhesive) vinyl tape, not less than 3 mils thick.

B. - Width: Provide 1-1/2-inch-wide tape markers on pipes with outside diameters (including insulation, if any) of less than 6 inch, 2-1/2 inch wide tape for larger pipes.

C. - Color: Comply with ANSI A13.1, except where another color selection is indicated.

1.15 DIAGRAM AND SCHEDULE FRAMES

A. - General: For each page of schedule and/or diagrams, provide glazed display frame, with screws for removable mounting on masonry walls. Provide frames of extruded aluminum, with SSB grade sheet glass.

1.16 ENGRAVED PLASTIC LAMINATE SIGNS

A. - General: Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in the sizes and thickness indicated, engraved with engraver's standard letter style of the sizes and wording indicated, white with black core (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.

B. - Thickness: 1/16 inch for units up to 20 square inches or 8 inch length, 1/8 inch for larger units.

C. - Fasteners: Self tapping stainless steel screws, except contact type permanent adhesive where screws cannot or should not penetrate the substrate.

1.17 LETTERING AND GRAPHICS

A. - General: Coordinate names, abbreviations and other designations used in mechanical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of mechanical systems and equipment.

B. - Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification which indicates individual system number as well as service (as examples; Boiler No. 3, Air Supply No. 1H, Standpipe F12).

1.18 CEILING TACKS

A. - Steel with 3/4-inch diameter color coded head.

B. - Color code as follows:
1. Yellow: HVAC equipment.
2. Red: Fire dampers/smoke dampers.

1.19 LOCKOUT DEVICES

A. - Lockout Hasps: Reinforced nylon hasp with erasable label surface, size minimum 7-1/4 x 3 inches

B. - Valve Lockout Devices: Nylon, steel or plastic device preventing access to valve operator, accepting lock shackle.

PART 3 - EXECUTION

1.20 GENERAL INSTALLATION REQUIREMENTS

A. - Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceiling and similar removable concealment.

1.21 DUCTWORK IDENTIFICATION

A. - General: Identify air supply, return, exhaust, intake and relief ductwork with duct markers; showing ductwork service and direction of flow, in black or white (whichever provides most contrast with ductwork color).

B. - Location: In each space where ductwork is exposed, or concealed only by removable ceiling system, locate signs near points where ductwork originates or continues into concealed enclosures (shaft, underground, or similar concealment) and at 50 foot spacing along exposed runs.

C. - Access Doors: Provide duct markers or stenciled signs on each access door in ductwork and housings, indicating purpose of access (to what equipment) and other maintenance and operating instructions, and appropriate safety and procedural information.

1.22 MECHANICAL EQUIPMENT IDENTIFICATION

A. - General: Install engraved plastic laminate sign or plastic equipment marker on or near each major item of mechanical equipment and each operational device, as specified herein if not otherwise specified for each item or device. Provide signs for the following general categories of equipment and operational devices:
1. - Main control and operating valves, including safety devices and hazardous units such as gas outlets.
2. - Meters, gages, thermometers and similar units.
3. - Fans, blowers, primary balancing dampers and mixing boxes.
4. - Packaged HVAC central station or zone type units.

B. - Lettering Size: Minimum 1/4-inch-high lettering for name of unit where viewing distance is less than 2'-0", 1/2 inch high for distance up to 6'-0", and proportionately larger lettering for greater distances. Provide secondary lettering of 2/3 to 3/4 of size of the principal lettering.

C. - Test of Signs: In addition to name of identified unit, provide lettering to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

1.23 ADJUSTING AND CLEANING

A. - Adjusting: Relocate any mechanical identification device which has become visually blocked by work of this division or other divisions.

B. Cleaning: Clean face of identification devices, and glass frames of valve charts.

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Testing, adjusting, and balancing of air systems.
   2. Measurement of final operating condition of HVAC systems.
   3. Sound measurement of equipment operating conditions.
   4. Vibration measurement of equipment operating conditions.

1.02 REFERENCES

A. Associated Air Balance Council:
   1. AABC MN-1 - National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
   1. ASHRAE 111 - Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning and Refrigeration Systems.

1.03 SUBMITTALS

A. Refer to Section 01 30 00 Submittals.

B. Prior to commencing Work, submit proof of latest calibration date of each instrument.

C. Test Reports: Indicate data on AABC MN-1 National Standards for Total System Balance forms containing information indicated in Schedules.

D. Field Reports: Indicate deficiencies preventing proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

E. Prior to commencing Work, submit report forms or outlines indicating adjusting, balancing, and equipment data required. Include detailed procedures, agenda, sample report forms and copy of AABC National Project Performance Guaranty.

F. Submit draft copies of report for review prior to final acceptance of Project.

G. Furnish reports in soft cover, letter size, 3-ring binder manuals, complete with table of contents page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.

H. Preliminary Submittals: Within 30 days after receipt of above preliminary information and data, the Agency shall submit the following through Contractor:

1. Agenda: Submit 3 sets of complete Agenda including drawings of the entire HVAC system to be balanced. Agenda shall represent final Total System Balance Report as per Chapter 29 of AABC National Standards, 1982, less field test data. Areas of intended field test inputs shall be represented by fully labeled blank spaces.
2. Pre-construction Plan Check and Construction Review Reports: Submit 3 sets of defined in AABC National Standards, latest edition (Chapter 25) including reports:
3. Demonstrating complete understanding of the design intent by the Test and Balance Agency.
4. Identifying potential problems for performing the Total System Balance and suggesting possible changes to allow most effective Total System Balance.
5. Total System Balance Schedule: Submit 3 sets of this schedule based on critical-path-network-analysis method and furnishing the Contractor and Authority's representative with a planning tool to include the testing and balancing into overall project schedule. Schedule shall consist of graphical and columnar reports and shall be updated periodically to reflect total project schedule.

I. Guarantee: Submit 3 sets of AABC National Project Performance Guaranty.

J. Certifications: Submit the certificates from mechanical Subcontractor as specified hereinafter.

K. Reports, Test Reports, and Information: Submit six sets as specified herein and Section 01 30 00.

1.04 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of flow measuring stations, balancing valves and rough setting.

B. Operation and Maintenance Data: Furnish final copy of testing, adjusting, and balancing report inclusion in operating and maintenance manuals.

1.05 WORK BY MECHANICAL SUBCONTRACTOR

A. Mechanical subcontractor shall certify in writing that the system, as scheduled for balancing, is operational and complete. Completeness shall include not only the physical installation, but mechanical subcontractor's certification that prime movers, fans, pumps, refrigeration machines, boilers, etc., are installed in good working order, and full load performance has been preliminarily tested under certification of mechanical subcontractor. Before any testing and balancing is started, a complete report shall be set to the Agency.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with AABC MN-1 National Standards for Field Measurement and Instrumentation, Total System Balance.

B. Maintain one copy of each document on site.

C. Prior to commencing Work, calibrate each instrument to be used. Upon completing Work, recalibrate each instrument to assure reliability.

1.07 QUALIFICATIONS

A. Qualifications of Agency: Total systems balance shall be performed by an independent Agency certified by the Associated Air Balance Council (AABC), which specializes in and whose business is dedicated to the testing, adjusting, and verification of HVAC system performance. Work of this section shall conform to AABC Specifications referred to in Chapters 17 through 26 of the AABC National Standards and other criteria as set forth in this Section.

B. Information furnished to the air balance agency: Agency shall be furnished with the following information and data:
   1. Preliminary: Within 30 days after selection and approval:
      a. Drawings of the work.
      b. Specifications covering all work to be tested and balanced.
      c. Written consent.
      d. Exceptions: Following shall be furnished as submittals are approved and the work progresses:
         i. Change orders affecting work to be tested and balanced.
         ii. Copies of approved submittals for work to be tested and balanced, including approved Shop Drawings, equipment submittals and the approved temperature control drawings.
         iii. Project schedule
         iv. Completely operable systems.

1.08 PRE-INSTALLATION MEETINGS

A. Convene minimum one week prior to commencing work of this section.

1.09 SEQUENCING

A. Sequence balancing between completion of systems tested and Date of Substantial Completion.

1.10 SCHEDULING

A. Schedule and provide assistance in final adjustment and test of life safety, smoke evacuation and smoke control system with Fire Authority.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify systems are complete and operable before commencing work. Verify the following:

1. Systems are started and operating in safe and normal condition.
2. Temperature control systems are installed complete and operable.
3. Proper thermal overload protection is in place for electrical equipment.
4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
5. Duct systems are clean of debris.
6. Fans are rotating correctly.
7. Fire and volume dampers are in place and open.
8. Air coil fins are cleaned and combed.
9. Access doors are closed and duct end caps are in place.
10. Air outlets are installed and connected.
11. Duct system leakage is minimized.
12. Proper strainer baskets are clean and in place or in normal position.
13. Service and balancing valves are open.

3.02 PREPARATION

A. Furnish instruments required for testing, adjusting, and balancing operations.

B. Make instruments available to Engineer to facilitate spot checks during testing.

3.03 INSTALLATION TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 3 percent of design.

B. Air Outlets and Inlets: Adjust total to within plus or minus 10 percent. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

3.04 ADJUSTING

A. Verify recorded data represents actual measured or observed conditions.

B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

C. After adjustment, take measurements to verify balance has not been disrupted. If disrupted, verify correcting adjustments have been made.

D. Report defects and deficiencies noted during performance of services, preventing system balance.

E. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

F. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by Authority.

G. Check and adjust systems approximately six months after final acceptance and submit report.

3.05 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems new and existing to obtain required or design supply, return, and exhaust air quantities at site altitude.

B. Make air quantity measurements in main ducts by Pitot tube traverse of entire cross-sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts.

E. Use volume control devices to regulate air quantities only to extent adjustments do not create objectionable air motion or sound levels. Effect volume control by using volume dampers located in ducts. Make drive changes, install additional dampers, etc. as may be required on the job at no additional cost to the Authority.

F. Vary total system air quantities by adjustment of fan speeds. Provide sheave drive changes to vary fan speed. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across fan. Make allowances for 50 percent loading of filters for the systems without VFD (variable frequency drive).

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

K. At modulating damper locations, take measurements and balance at extreme conditions. Balance variable volume systems at maximum airflow rate, full cooling, and at minimum airflow rate, full heating.

L. Measure building static pressure and adjust supply, return, and exhaust air systems to obtain required relationship between each to maintain approximately 0.05 inches positive static pressure near building entries.

3.06 WATER SYSTEM PROCEDURE

A. Adjust water systems, after air balancing, to obtain design quantities.

B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow-metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in system.

C. Adjust systems to obtain specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

D. Effect system balance with automatic control valves fully open or in normal position to heat transfer elements.

E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

3.07 DUCT PRESSURE TESTING

A. General
1. High, medium, and low-pressure ductwork systems shall be tested during construction prior to insulation. Test ducts lengths a maximum of 100 feet at time for risers and 150 feet for horizontal ducts. All ductwork tested and approved prior to installation of insulation.
2. Riser branches shall be isolated with seals, plugs, or caps. Riser installed in shafts shall be tested in sections to allow erection of shaft wall and duct insulation as approved by Engineer.
3. Tests shall be performed in presence of the Engineer who must verify recorded test data for test pressure and air leakage for tested duct length.
4. Test equipment: Rotary blower, calibrated orifice section, and gauge board.
5. Pressure test procedure:
    a. Check and alert the Mechanical Contractor of any required seals of all openings in duct and plenum section to be tested.
    b. Connect the test apparatus to test section using a flexible duct connection or hose.
    c. Close damper on blower suction side, to prevent excessive build-up of pressure.
    d. Start blower and gradually open damper on suction side of blower.
    e. Build-up pressure on test section to required limit.
    f. Determine amount of air leakage by make-up air flow measurements and make repairs as required.
    g. Total allowable leakage shall not exceed 1% per minute based upon the total operating CFM of the system being tested. Total leakage is determined by summation of leakage for each section of system tested.
    h. All negative pressure ducts, including return and exhaust system shall be tested by same procedure as positive pressure supply ducts.
    i. Report final results of duct testing.

B. Main Supply Ductwork Systems: Extending from the discharge of supply fans to the inlet of air terminal units.
1. Test pressures: 4-inch WG.
2. The allowable leak measured in CFM varies depending upon the length of duct tested and as follows:
    a. Main duct maximum 1% of the designed CFM on the total length and proportioned to the duct being tested.
    b. Branch duct or risers maximum of 1% of the designed CFM on the total length and proportioned to the duct being tested.

C. Branch Ductwork Systems: Extending from the air terminal to diffuser, return and exhaust air ducts.
   1. Test pressures: 2-inch WG.
   2. The allowable leak measured in CFM varies depending upon the length of duct tested and as follows:
      a. Main duct maximum 1% of the designed CFM on the total length and proportioned to the duct being tested.
      b. Branch duct or risers maximum 1% of the designed CFM on the total length and proportioned to the duct being tested.
      c. The allowable leakage shall not exceed 1% per minute based upon the total peak operating CFM of system being tested. Total leakage is determined by summation of leakage for each section of the system tested.

D. Leak tests shall be performed and recorded separately for each system for:
   1. Main duct.
   2. Branch duct or risers.
   3. Complete system.

E. Test Failures: Notify General Contractor to repair duct system if test pressure and leakage is not attained. Repairs and sealing to be done with sheet metal and sealant by Mechanical Contractor Division 23.

3.08 SCHEDULES

A. Equipment Requiring Testing, Adjusting, and Balancing:
   1. Rooftop Packaged Heat Pump.
   2. Fans.
   3. Air Filters.
   4. Air Inlets and Outlets.

B. Report Forms
   1. Title Page:
      a. Name of Testing, Adjusting, and Balancing Agency
      b. Address of Testing, Adjusting, and Balancing Agency
      c. Telephone and facsimile numbers of Testing, Adjusting, and Balancing Agency
      d. Project name
      e. Project location
      f. Project Architect
      g. Project Engineer
      h. Project Contractor
      i. Project altitude
      j. Report date
   2. Summary Comments:
   3. Design versus final performance
   4. Notable characteristics of system
   5. Description of systems operation sequence
   6. Summary of outdoor and exhaust flows to indicate building pressurization
   7. Nomenclature used throughout report
   8. Test conditions
   9. Instrument List:

a. Instrument
b. Manufacturer
c. Model number
d. Serial number
e. Range
f. Calibration date

10. Electric Motors:
    a. Manufacturer
    b. Model/Frame
    c. HP/BHP and kW
    d. Phase, voltage, amperage; nameplate, actual, no load
    e. RPM
    f. Service factor
    g. Starter size, rating, heater elements
    h. Sheave Make/Size/Bore
11. V-Belt Drive:
    a. Identification/location
    b. Required driven RPM
    c. Driven sheave, diameter and RPM
    d. Belt, size and quantity
    e. Motor sheave diameter and RPM
    f. Center to center distance, maximum, minimum, and actual
12. Cooling Coil Data:
    a. Identification/number
    b. Location
    c. Service
    d. Manufacturer
    e. Air flow, design and actual
    f. Entering air DB temperature, design and actual
    g. Entering air WB temperature, design and actual
    h. Leaving air DB temperature, design and actual
    i. Leaving air WB temperature, design and actual
    j. Water flow, design and actual
    k. Water pressure drop, design and actual
    l. Entering water temperature, design and actual
    m. Leaving water temperature, design and actual
    n. Saturated suction temperature, design and actual
    o. Air pressure drop, design and actual
13. Air Handling Equipment:
    a. Location
    b. Manufacturer
    c. Model number
    d. Serial number
    e. Arrangement/Class/Discharge
    f. Air flow, specified and actual
    g. Return air flow, specified and actual
    h. Outside air flow, specified and actual
    i. Total static pressure (total external), specified and actual
    j. Inlet pressure
    k. Discharge pressure
    l. Sheave Make/Size/Bore

m. Number of Belts/Make/Size
n. Fan RPM

14. Return Air/Outside Air Data:
    a. Identification/location
    b. Design air flow
    c. Actual air flow
    d. Design return air flow
    e. Actual return air flow
    f. Design outside air flow
    g. Actual outside air flow
    h. Return air temperature
    i. Outside air temperature
    j. Required mixed air temperature
    k. Actual mixed air temperature
    l. Design outside/return air ratio
    m. Actual outside/return air ratio
15. Exhaust Fan Data:
    a. Location
    b. Manufacturer
    c. Model number
    d. Serial number
    e. Air flow, specified and actual
    f. Total static pressure (total external), specified and actual
    g. Inlet pressure
    h. Discharge pressure
    i. Sheave Make/Size/Bore
    j. Number of Belts/Make/Size
    k. Fan RPM
16. Duct Traverse:
    a. System zone/branch
    b. Duct size
    c. Area
    d. Design velocity
    e. Design air flow
    f. Test velocity
    g. Test air flow
    h. Duct static pressure
    i. Air temperature
    j. Air correction factor
17. Duct Leak Test:
    a. Description of ductwork under test
    b. Duct design operating pressure
    c. Duct design test static pressure
    d. Duct capacity, air flow
    e. Maximum allowable leakage duct capacity times leak factor
    f. Test apparatus
    g. Blower
    h. Orifice, tube size
    i. Orifice size
    j. Calibrated
    k. Test static pressure

l. Test orifice differential pressure
m. Leakage

18. Air Distribution Test Sheet:
    a. Air terminal number
    b. Room number/location
    c. Terminal type
    d. Terminal size
    e. Area factor
    f. Design velocity
    g. Design air flow
    h. Test (final) velocity
    i. Test (final) air flow
    j. Percent of design air flow

END OF SECTION

SECTION 23 07 00

HVAC INSULATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. HVAC piping insulation, jackets and accessories.
2. HVAC ductwork insulation, jackets, and accessories.
3. Insulation accessories including vapor retarders and accessories.

B. Related Sections:
1. Section 09 90 00 - Painting and Coating.
2. Section 23 05 29 – Hangers and Supports for HVAC and Plumbing Piping and Equipment.
3. Section 23 05 53 – Identification for HVAC Piping and Equipment.

1.02 REFERENCES

A. ASTM International:
1. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
2. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
3. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.
4. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
5. ASTM C450 - Standard Practice for Prefabrication and Field Fabrication of Thermal Insulating Fitting Covers for NPS Piping, Vessel Lagging, and Dished Head Segments.
6. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.
7. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
8. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.
9. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
10. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
11. ASTM C585 - Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
12. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
13. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
14. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

15. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
16. ASTM C1071 - Standard Specification for Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material).
17. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
18. ASTM C1290 - Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts.
19. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
20. ASTM D4637 - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane.
21. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
22. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
23. ASTM E162 - Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source.

B. Sheet Metal and Air Conditioning Contractors':
   1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

C. National Fire Protection Association:
   1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

D. Underwriters Laboratories Inc.:
   1. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
   2. UL 1978 - Standard for Safety for Grease Ducts.

1.03 SUBMITTALS

A. Refer to Section 01 30 00 Submittals, for submittal requirements.

B. Product Data: Submit product description, thermal characteristics and list of materials, R value, finished accessories and thickness for each service, and location.

C. Manufacturer's Installation Instructions: Submit manufacturers published literature indicating proper installation procedures.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

E. Acceptance or no exceptions taken by the engineer on any substitution proposed by the contractor shall not be construed as relieving the contractor from compliance with the project's specifications and performance requirements nor departure there from. The contractor remains responsible for details and accuracy for confirming and correlating quantities and dimensions and for the selection of fabrication processes, techniques and assembly, coordination of his work with that of all other trades and making any needed modifications consequent to the substitution at his own cost and for performing the work in a safe manner.

1.04 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Applicator: Company specializing in performing work of this section with minimum three years documented experience.

1.05 QUALITY ASSURANCE

A. Test pipe insulation for maximum flame spread index of 25 and maximum smoke developed index of not exceeding 50 in accordance with ASTM E84, UL 723, and NFPA 255.

B. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.

C. Factory fabricated fitting covers manufactured in accordance with ASTM C450.

D. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame spread index of 25 or less, and smoke developed index of 50 or less, in accordance with UBC standard No. 42-1 except where more stringent requirements are noted.

E. Insulation materials shall be tested by Underwriters Laboratories, Inc. (UL). Tests shall include insulation, jackets, fittings, adhesives, coatings and accessories. Composite products shall meet the fire hazard requirements of NFPA 90A.

F. Furnish affidavit from manufacturer that products delivered to project meet requirements specified

G. Maintain one copy of each document on site.

1.06 PRE-INSTALLATION MEETINGS

A. Division 01 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

1.08 ENVIRONMENTAL REQUIREMENTS

A. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.

B. Maintain temperature before, during, and after installation for minimum period of 24 hours.

1.09 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.10 WARRANTY

A. Furnish five-year manufacturer warranty for man-made fiber.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Manufacturer: Subject to compliance with requirements, provide products of one of the following.
   1. Owens-Corning.
   2. Armstrong World Industries, Inc.
   3. CertainTeed.
   4. Knauf.
   5. Or equal.

2.02 PIPE INSULATION

A. Fiberglass (Mineral Fiber) Piping Insulation: ASTM C547, Class 1 unless otherwise indicated. Owens Corning Fiberglass Corp., ASJ/SL-II, Manville Products Corp. Micro-Lok, or equal.

B. Jackets for Piping Insulation: ASTM C921, Type I (Vapor Barrier) for piping with temperatures below ambient. Type I insulation may be used for all piping at the installer's option.
   1. Encase pipe fittings insulation with one-piece remolded PVC fitting covers, fastened per manufacturer's recommendations.
   2. Encase exterior piping insulation with aluminum jacket with weatherproof construction. Unjacketed fiberglass insulation meeting ASTM C-547, Class I, may be used at Contractor's option.

C. Staples, Bands, Wires, and Cement: As recommended by insulation manufacturer for applications indicated.

D. Adhesives, Sealers, and Protective Finishes: As recommended by insulation manufacturer for applications indicated.

2.03 DUCTWORK INSULATION MATERIALS

A. Rigid Fiberglass Ductwork Insulation: ASTM C612, Class 1, 3-5 lbs/ft3.

B. Flexible Fiberglass Ductwork Insulation: ASTM C1290, with ASTM C1136 Type II vapor barrier jacket. Owens-Corning Fiberglass All Service Wrap Insulation, Type 75 or CertainTeed Wide Wrap, Type 75 or equal:

1. R8 minimum installed insulation for all supply and return ducts. Applies to ducts located in unconditioned spaces, such as outdoors, spaces between roof and insulated ceiling, space directly under roof, which is unconditioned space.
2. R4.2 minimum installed insulation for all supply ducts for all “other” spaces not listed above (i.e., conditioned space).
3. Additions, alternations, and repairs.
4. R8 minimum installed insulation for all supply and return ducts (unconditioned spaces – see above) and R4.2 installed insulation for all supply ducts (conditioned spaces – see above) whenever:
   a. Ducts are to be extended to serve a new addition.
   b. New ducts are installed or existing ducts replaced with new ducts in an existing building.
5. Density of 0.75 pcf (Type 75) and thicknesses below shall be used to provide installed R-value as follows:
6. Nominal 1-inch thickness or equivalent to provide installed R-value as follows:
   a. Type 75 1-1/2” Thick R = 4.2
   b. Type 75 3 " Thick R = 8.3

C. Duct Liner: ASTM C1071, Type II, rigid, glass fiber duct liner with coated air side.
1. Thermal Conductivity: 0.23 at 75 degrees F.
2. Density: 3.0 pound per cubic foot.
3. Maximum Operating Temperature: 250 degrees F.
4. Maximum Air Velocity: 4,000 feet per minute.

D. Ductwork Insulation Accessories: Provide staples, bands, wires, tape, anchors, corner angles and similar accessories as recommended by insulation manufacturer for applications indicated.

E. Ductwork Insulation Compounds: Provide cements, adhesives, coatings, sealers, protective finishes and similar compounds as recommended by insulation manufacturer for applications indicated.

2.04 ALUMINUM PIPE JACKET

A. ASTM B209, 0.025-inch-thick sheet.

B. Finish: Embossed

C. Joining: Longitudinal slip joints and 2-inch laps

D. Fittings 0.016-inch-thick die shaped fitting covers with factory attached protective liner.

E. Metal Jacket Bands: 3/8-inch-wide, 0.015 inch thick aluminum.

2.05 FIELD-APPLIED JACKETS

A. General: ASTM C 921, Type 1.

B. Aluminum Jacket: Stucco-embossed finish sheets manufactured from aluminum alloy complying with ASTM B 209, and having an integrally bonded moisture barrier over

entire surface in contact with insulation. Metal thickness shall be .024" for outdoor applications.

C. Moisture Barrier: 3-mil- thick, heat-bonded polyethylene or Kraft paper.

D. Stainless Steel Jacket: Deep corrugated sheets of stainless steel complying with ASTM A666, Type 304 or 316, 0.16-inch-thick, and roll stock ready for shop or field cutting and forming to indicated sizes.
1. Moisture Barrier: 3 mils thick, heat bonded polyethylene and kraft paper.
2. Jacket Bands: Stainless steel, Type 304, 3/4 inch wide.

2.06 INSULATING CEMENTS (DUCTWORK AND EQUIPMENT)

A. Mineral Fiber Insulating Cement: Comply with ASTM C 195.
1. Manufacturers:
a. Insulco, Division of MFS, Inc.: Triple I.
b. P.K. Insulation Mfg. Co., Inc.: Super-Stik
c. Or equal.

B. Mineral Fiber Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.
1. Manufacturers:
a. Insulco, Division of MFS, Inc.: SmoothKote.
b. P.K. Insulation Mfg. Co., Inc.: P.K. No. 127 and Quick-Cote
c. Rock Wool Manufacturing Co.; Delta One Shot
d. Or equal.

2.07 ADHESIVES (DUCTWORK)

A. Manufacturers:
1. Childers Products, Division of ITW; CP-82.
2. Foster Products Corporation, H. B. Fuller Company; 85-20.
3. ITW TACC, Division of Illinois Tool Works; S-90/80
4. Marathon Industries, Inc.; 225
5. Mon-Eco Industries, Inc.; 22-25
6. Or equal.

B. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

2.08 MASTICS (DUCTWORK)

A. Manufacturers:
1. Childers Products, Division of ITW; CP-35.
2. Foster Products Corporation, H. B. Fuller Company; 30-90.
3. ITW TACC, Division of Illinois Tool Works; CB-50
4. Marathon Industries, Inc.; 590
5. Mon-Eco Industries, Inc.; 55-40
6. Vimasco Corp.; 749

7. Or equal

B. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

C. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

D. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.

E. Service Temperature Range: Minus 20 to plus 180 degrees F.

F. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.

G. Color: White.

2.09 SEALANTS

A. FSK and Metal Jacket:
1. Manufacturers:
   a. Childers Products, Division of ITW; CP-76-8
   b. Foster Products Corp. H.B. Fuller Co.; 95-44
   c. Marathon Industries, Inc., 405
   d. Mon-Eco Industries, Inc.; 44-05
   e. Vimasco Corp; 750
   f. Or equal.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.

B. ASJ Flashing Sealants (Ductwork)
1. Manufacturer: Childers Products, Division of TTW; CP-76
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire and water resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 degrees F.
5. Color: White

2.10 ACCESSORIES AND ATTACHMENTS

A. Weld-Attached Anchor Pins and Washers: Copper-coated steel pin for capacitor-discharge welding and galvanized speed washer. Pin length sufficient for insulation thickness indicated.
1. Welded Pin Holding Capacity: 20 lb for direct pull perpendicular to the attached surface.

B. Adhesive-Attached Anchor Pins and Speed Washers: Galvanized steel plate, pin, and washer manufactured for attachment to duct and plenum with adhesive. Pin length sufficient for insulation thickness indicated. May be used for heating and hot water systems.

1. Adhesive: Recommended by the anchor pin manufacturer as appropriate for surface temperatures of ducts, plenums, and breechings; and to achieve a holding capacity of 20 lb for direct pull perpendicular to the adhered surface.

C. Bands: Minimum 1/2-inch-wide, in one of the following materials compatible with jacket:
1. Stainless Steel: ASTM A666, Type 304; 0.020 inch thick.
2. Aluminum 0.007 inch thick.

D. Wire: 0.080-inch, nickel copper alloy, 0.062 inch soft annealed stainless steel, or 0.062 inch soft annealed galvanized steel.

E. Weld Attached Anchor Pins and Washers for Chilled Water System: Copper coated steel pin for capacitor discharge welding and galvanized speed washer. Pin length sufficient for insulation thickness indicated.
1. Welded Pin Holding Capacity: 20 lbs for direct pull perpendicular to the attached surface.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Division 01 - Administrative Requirements: Coordination and project conditions.

B. Examine areas and conditions which mechanical insulation is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to installer.

C. Verify piping, equipment and ductwork has been tested before applying insulation materials.

3.02 DUCTWORK SYSTEM INSULATION:

A. Insulation Omitted: Do not insulate lined ductwork.

B. Hot/Cold Ductwork:
1. Application Requirements: Insulate the following ductwork:
a. HVAC supply ductwork, unconditioned space and exposed ductwork R-8, above ceiling grid indirectly conditioned space R-4.2.
b. HVAC return ductwork, unconditioned space R-8, above ceiling grid indirectly conditioned space R-4.2.
c. HVAC plenums and unit housings not pre-insulated at factory to geographical R-value requirements based on California Title 24, R-4.2, R-6 or R-8.
2. Insulate each ductwork system specified above with one of the following types and thickness of insulation as indicated:
a. Rigid Fiberglass: 2-inch-thick, (Owens Corning 703 FRK R-8 or CertainTeed ToughGard Duct Board or equal)
b. Flexible Fiberglass: Type 75 (0.75 pcf), 1-1/2 inch thick in conditioned space (R4.2) or 3 inch thick in unconditioned space (R-8), application limited to concealed locations.

3.03 INSTALLATION OF DUCTWORK INSULATION

A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.

B. Install insulation materials with smooth and even surfaces.

C. Clean and dry ductwork prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.

D. Maintain integrity of vapor barrier on ductwork insulation, and protect it to prevent puncture and other damage.

E. Extend ductwork insulation without interruption through walls, floors and similar ductwork penetrations, except where otherwise indicated.

F. Lined ductwork: Except as otherwise indicated, omit external insulation on ductwork where internal insulation or sound absorbing linings have been installed.

G. Ductwork Exposed to Weather and Exposed to view: Cover exposed to weather duct insulation with 26-gauge galvanized sheet metal, sides, top and bottom with standing seams. Pitch for drainage.

H. Ductwork and sheet metal plenums exposed to view (Ductwork in the mechanical rooms): Insulate to California Title 24 requirements. If space is unconditioned provide 3-inch-thick, 3/4 pounds per cubic foot density FRK faced glass fiber blanket. If space is indirectly conditioned, provide 1-1/2-inch-thick 3/4 pounds per cubic foot density FRK faced glass fiber blanket. Tightly butt joints. Secure with 18-gauge tie wire. Corner angles shall overlap at least two sheet metal screws at each side.

3.04 PROTECTION AND REPLACEMENT

A. Replace damaged insulation that cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

B. Protection: Insulation Installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damaged and deterioration.

END OF SECTION

SECTION 23 11 23

FACILITY NATURAL GAS PIPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Natural gas piping.
2. Valves.
3. Unions.
4. Natural gas pressure regulators.

B. Related Sections:

1. Section 22 05 23 – General Duty Valves for Plumbing Piping
2. Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment
3. Section 22 05 53 – Identification for Plumbing Piping and Equipment

1.02 REFERENCES

A. American Society of Mechanical Engineers:

1. ASME B16.3 - Malleable Iron Threaded Fittings.
2. ASME B16.33 - Manually Operated Metallic Gas Valves for Use in Gas Piping Systems Up to 125 psig (sizes 1/2 - 2).
3. ASME B31.9 - Building Services Piping.
4. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

B. ASTM International:

1. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. ASTM A234 - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
3. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.

C. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.

2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.

3. MSS SP 78 - Cast Iron Plug Valves, Flanged and Threaded Ends.

4. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

D. National Fire Protection Association:

1. NFPA 54 - National Fuel Gas Code.

1.03 SYSTEM DESCRIPTION

A. Provide all necessary piping, fittings, and accessories as required and as designated in this section for a complete and fully functional natural gas system.

B. Provide unions at locations requiring servicing. Use unions downstream of valves. Do not use direct welded or threaded connections to valves.

C. Provide pipe hangers and supports in accordance with ASME B31.9, MSS SP 58, MSS SP 69, and MSS SP 89.

D. Use plug valves for shut-off and to isolate equipment.

1.04 SUBMITTALS

A. Section 01 30 00 - Submittals Procedures: Submittal procedures.

B. Product Data:

1. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturers catalog information.

2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.

3. Gas Pressure Regulators: Submit manufacturers catalog information including capacity, rough-in requirements, and service sizes.

C. Test Reports: Indicate results of piping system pressure test.

D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

E. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

1.05 QUALITY ASSURANCE

A. Perform natural gas Work in accordance with NFPA 54.

B. Perform work in accordance with 2013 California Plumbing Code.

C. Perform Work in accordance with ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.

D. Furnish shutoff valves complying with ASME B16.33 or ANSI Z21.15.

E. Maintain one copy of each document on site.

1.06 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.07 PRE-INSTALLATION MEETINGS

A. Convene in sufficient time with the gas company in order for SDG&E to schedule the planned work. This is a prerequisite of the Contractor prior to commencing work of this section.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 – Product Requirements: Product storage and handling requirements.

B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

C. Protect piping and fittings from soil and debris with temporary end caps and closures. Maintain in place until installation.

1.09 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 - PRODUCTS

2.01 NATURAL GAS PIPING

A. Steel Pipe: ASTM A53 Schedule 40 black.

1. Fittings: ASME B16.3, malleable iron, or ASTM A234 forged steel welding type.

2. Joints: Threaded for pipe 2 inches and smaller; welded for pipe 2-1/2 inches and larger.

3. Field applied primer and epoxy paint coating on all exposed pipe and fittings, or galvanized pipe and fittings shall be provided.

2.02 PLUG VALVES

A. Acceptable Manufacturers:

1. Mueller Co.

2. A.Y. McDonald Mfg. Co.

3. Red-White Valve Corp.

4. Nordstrom Valves, Inc.

B. 2 inches and Smaller: MSS SP 78, Class 150, square port, full pipe area regular opening, pressure lubricated, Teflon packing, threaded ends.

C. 2-1/2 inches and Larger: MSS SP 78, Class 150, square port, full pipe area regular opening, pressure lubricated, Teflon packing flanged ends.

2.03 UNIONS AND FLANGES

A. Unions for Pipe 2 inches and Smaller: Ferrous Piping: ASME B16.39, Class 150, malleable iron, threaded ends, ground joint.

B. Flanges for Pipe 2-1/2 inches and Larger: Ferrous Piping: ASME B16.39, Class 150, forge steel, slip-on-flanges.

C. Dielectric Connections: Union with galvanized or plated steel threaded end, water impervious isolation barrier.

2.04 NATURAL GAS PRESSURE REGULATORS

A. Acceptable Manufacturers:

1. American Meter

2. Maxitrol

3. Rockwell

4. Fisher

B. Product description: Spring loaded, general purpose, self-operation service regulator including internal relief type diaphragm and vent valve.

1. Comply with ANSI Z21.80

2. Temperature: minus 20 degrees F, to 150 degrees F.

3. Body: cast iron or steel.

4. Spring case, lower diaphragm casing, union ring, seat ring and disk holder: Aluminum.

5. Disk, diaphragm, and O-ring: Nitrile.

6. Maximum inlet pressure: 150 psig.

7. Furnish sizes 2 inches and smaller with threaded ends.

2.05 PIPE HANGERS AND SUPPORTS

A. Manufacturers:

1. Carpenter & Paterson Inc.

2. B-Line

3. Michigan Hanger Co.

B. Conform to NFPA 54, ASME 31.9, MSS SP 58, MSS SP 69, and MSS SP 89.

C. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.

D. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.

PART 3 - EXECUTION

3.01 PREPARATION

A. Ream pipe ends. Remove burrs.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.02 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Install pipe hangers and supports in accordance with Section 22 05 29.

3.03 INSTALLATION - PIPING SYSTEMS

A. Install natural gas piping in accordance with NFPA 54.

B. Drips and Sediment Traps: Install drip at points where condensate may collect. Locate where readily accessible for cleaning and emptying. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use minimum length nipple of 3 pipe diameters, but not less than 3 inches long, and same size as connected pipe. Install with space between bottom of drip and floor for removal of plug or cap. Install as close as practical to inlet of appliance or equipment using gas.

C. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

D. Route piping in orderly manner and maintain gradient.

E. Install piping to allow for expansion and contraction without stressing pipe or joints.

F. Provide clearance for access to valves and fittings.

G. Install identification on piping systems. Refer to Section 22 05 23.

H. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

I. All exterior piping exposed above ground shall be painted. Remove pipe coating material, rust, dirt, grease etc. Prepare surfaces to be painted are dry and free of moisture. Apply one prime coat of rust inhibitive primer. Apply two finish coats of heavy duty rust inhibitive paint. Allow proper drying time between coats.

3.04 PIPE JOINTS

A. Welded Joints: Comply with the requirements in ASME Boiler and Pressure Vessel Code, Section IX.

B. Threaded Joints: Conform to ANSI B1.20.1, tapered pipe threads for field cut threads. Join pipe, fittings, and valves as follows:

1. Note the internal length of threads and fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint. Refer to NFPA 54, for guide for number and length of threads for field threading steel pipe.

2. Align threads at point of assembly.

3. Apply appropriate tape or thread compound to the external pipe threads.

4. Assemble joint to appropriate thread depth. When using a wrench on valves, place the wrench on the valve end into which the pipe is being threaded.

5. Damaged Threads: Do not use pipe with threads which are stripped, chipped, corroded, or otherwise damaged. If a weld opens during cutting or threading operations, that portion of pipe shall not be used.

3.05 VALVE INSTALLATIONS

A. Install valves in accessible locations, protected from physical damage. Tag valves with a metal tag attached with a metal chain indicating the piping systems supplied.

B. Install valves with stems upright or horizontal, not inverted.

C. Install valves for shut off and to isolate parts of the system.

3.06 FIELD QUALITY CONTROL

A. Pressure test natural gas piping in accordance with NFPA 54.

B. Inspect, test and purge gas piping in accordance with applicable code.

C. When pressure tests do not meet specified requirements, remove defective work, replace and retest.

END OF SECTION

SECTION 23 31 00

HVAC DUCTS AND CASINGS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Duct Materials.
   2. Insulated flexible ducts.
   3. Single wall spiral round ducts.
   4. Transverse duct connection system.
   5. Casings.
   6. Ductwork fabrication.
   7. Duct cleaning.

B. Related Sections:
   1. Section 09 90 00 - Painting and Coating
   2. Section 23 05 29- Hangers and Supports for HVAC Piping
   3. Section 23 37 00 – Air Outlets and Inlets.
   4. Section 23 33 00 – Air Duct Accessories.

1.02 REFERENCES

A. ASTM International:
   1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
   2. ASTM A90/A90M - Standard Test Method for Weight Mass of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
   3. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
   4. ASTM A568/A568M - Standard Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for.
   5. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   6. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
   7. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
   8. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
   9. ASTM C14 - Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.
   10. ASTM C443 - Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
   11. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

B. California Mechanical Code
   1. CMC – State of California Mechanical Code

C. National Fire Protection Association:
   1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
   2. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems.
   3. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

D. Sheet Metal and Air Conditioning Contractors:
   1. SMACNA - Fibrous Glass Duct Construction Standards.
   2. SMACNA - HVAC Air Duct Leakage Test Manual.
   3. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

E. Underwriters Laboratories Inc.:
   1. UL 181 - Factory-Made Air Ducts and Connectors.

1.03 PERFORMANCE REQUIREMENTS

A. Variation of duct configuration or sizes other than those of equivalent or lower loss coefficient is not permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts, if it is not shown on the drawings.

1.04 SUBMITTALS

A. Refer to Section 01 30 00 Submittals, for submittal requirements.

B. Shop Drawings: Submit duct fabrication drawings, drawn to scale not smaller than 1/4 inch equals 1 foot, on drawing sheets same size as Contract Documents, indicating:
   1. Fabrication, assembly, and installation details, including plans, elevations, sections, details of components, and attachments to other work.
   2. Duct layout, indicating pressure classifications and sizes in plan view. For exhaust duct systems, indicate classification of materials handled as defined in this section.
   3. Fittings.
   4. Reinforcing details and spacing.
   5. Seam and joint construction details.
   6. Penetrations through fire rated and other walls.
   7. Terminal unit, coil, and humidifier installations.
   8. Hangers and supports, including methods for building attachment, vibration isolation, and duct attachment.
   9. Equipment service clearance, access panels and door swings.

C. Product Data: Submit data for duct materials, duct liner and duct connectors.

D. Test Reports: Indicate pressure tests performed. Include date; section tested, test pressure, and leakage rate, following SMACNA HVAC Air Duct Leakage Test Manual.

E. Acceptance or no exceptions taken by the engineer on any substitution proposed by the contractor shall not be construed as relieving the contractor from compliance with the project's specifications and performance requirements nor departure there from. The contractor remains responsible for details and accuracy for confirming and correlating quantities and dimensions and for the selection of fabrication processes, techniques and assembly, coordination of his work with that of all other trades and making any needed modifications consequent to the substitution at his own cost and for performing the work in a safe manner.

1.05 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with SMACNA - HVAC Duct Construction Standards - Metal and flexible.

B. Construct ductwork to NFPA 90A and NFPA 96 standards.

C. Maintain one copy of each document on site.

1.07 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.

1.08 PRE-INSTALLATION MEETINGS

A. Convene minimum three weeks prior to commencing work of this section.

1.09 ENVIRONMENTAL REQUIREMENTS

A. Do not install duct sealant when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures during and after installation of duct sealant.

1.10 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 - PRODUCTS

2.01 DUCT MATERIALS

A. Galvanized Steel Ducts: ASTM A653/A653M galvanized steel sheet, lock-forming quality, having G90 zinc coating of in conformance with ASTM A90/A90M.

B. Steel Ducts: ASTM A1008/A1008M, ASTM A1011/A1011M, ASTM A568/A568M.

C. Aluminum Ducts: ASTM B209; aluminum sheet, alloy 3003-H14. Aluminum Connectors and Bar Stock: Alloy 6061-T6 or of equivalent strength.

D. Stainless Steel Ducts: ASTM A167, Type 304 or 316.

E. Fasteners: Rivets, bolts, or sheet metal screws.

F. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

G. Ducts exposed to water shall be sloped so rainwater will not stand on top of duct.

2.02 INSULATED FLEXIBLE DUCTS

A. Manufacturers:
   1. Casco
   2. Glass Flex
   3. Glen Flex
   4. Or equal.

B. Product Description: Flexible duct shall consist of an exterior reinforced laminated vapor barrier, 1-1/2-inch-thick fiberglass insulation (K = .25 @ 75 degrees F), 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. Flexible fiberglass duct shall meet the requirements of NFPA No. 90A and UL 181.
   1. Pressure Rating: 10 inches wg positive and 1.0 inches wg negative.
   2. Maximum Velocity: 4000 fpm.
   3. Temperature Range: -10 degrees F to 160 degrees F.
   4. Furnish each flexible duct section with integral clamping devices for connection to round or oval fittings.
   5. Join each flexible duct section to main trunk duct through sheet metal fittings. Construct fittings of galvanized steel and equip with factory installed volume damper having positive locking regulator. Provide fittings installed in lined ductwork with insulation guard.
   6. Flexible ducts shall be supported at or near mid-length with 2 inch wide, 28 gauge 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 7 feet and minimum length of 5 feet. Flexible ductwork is not permitted for Surgery, OR, Delivery, Nursery Rooms, Isolation Rooms, Recovery, Special Procedure, and all other sensitive areas

2.03 SINGLE WALL SPIRAL ROUND DUCTS

A. Manufacturers:
   1. McGill Airflow Corporation
   2. Semco Incorporated
   3. Tangent Air Corp

4. Spiral Mfg. Co., Inc.
5. Or equal.

B. Product Description: UL 181, Class 1, round spiral lock seam duct constructed of galvanized steel.

C. Duct Coating for Underground Ducts: Polyvinyl chloride plastic, 4 mil thick on outside. Temperature range: minus 30 degrees F to 200 degrees F.

D. Construct duct with the following minimum gauges:

	Gauge
3 inches to 14 inches	26
15 inches to 26 inches	24
28 inches to 36 inches	22
38 inches to 50 inches	20
52 inches to 84 inches	18

E. Construct fittings with the following minimum gauges:

Diameter	Gauge
3 inches to 14 inches	24
15 inches to 26 inches	22
28 inches to 36 inches	20
38 inches to 50 inches	20
52 inches to 60 inches	18
62 inches to 84 inches	16

2.04 RECTANGULAR DUCTWORK FABRICATION

A. Low Pressure Duct Construction Schedule: (2 inch" S.P. and below). Include all return, exhaust, supply branches and ductwork downstream of terminal units.

Duct Dimension (Inches)	Material Gauges	Construction of Transverse Joints, Bracing and Reinforcing
0 to 12	26	Hemmed S slip spaced not more than 10’ apart
13 to 30	24	Ductmate Jr.**, or 1” G lock spaced not more than 10’ apart
31 to 42	22	Ductmate Jr.**, spaced not more than 5’ apart
43 to 54	22	Ductmate**, spaced not more than 4’ apart
55 to 60	20	Ductmate**, spaced not more than 4’ apart
61 to 84	20	Ductmate**, spaced not more than 4’ apart
85 and up	18	Ductmate**, spaced not more than 4’ apart. Provide intermediate bracing for low pressure ductwork 85” and larger

Note: * Based on maximum of 2.0" WG.

**The Lockformer Company TDC or equal

Provide intermediate bracing for low pressure ductwork 85 inches and larger.

All ducts over 18 inches in either dimension shall be stiffened with beads on 24 through 20 gauge. Cross break on 18 and 16 gauge. Longitudinal seams shall be Pittsburgh locks Snap-Lock shall be limited to 12 inch maximum width of ducts.

B. High Pressure Duct Construction Schedule: (2-1/4" S.P. and above). Include all supply ducts on the roof, vertical supply ducts, and horizontal main supply ducts upstream of terminal units.

Duct Dimension (Inches)	*Material	Construction of Transverse
0 to 30	22	Ductmate**, or 1" G lock spaced not more than 4' apart
31 to 42	20	Ductmate**, spaced not more than 4’ apart

43 to 54	20	Ductmate**, spaced not more than 4’ apart
55 to 60	18	Ductmate**, spaced not more than 4’ apart 2”x2”x18 ga angle reinforcing located midway between joints
61 to 84	18	Ductmate**, spaced not more than 4’ apart 22”x22”x18 ga angle reinforcing located midway between joints
85 and up	18	Ductmate**, spaced not more than 4’ apart 22”x22”x18 ga angle reinforcing located midway between joints

Note: * Based on max. of 4.0" W.G.

** The Lockformer Company TDC or equal

Tie rods up to 36 inch, 1/4 inch diameter, over 36 inch", 3/8 inch diameter. All ducts over 18 inch either dimension are stiffened with beads on 24 through 18 gauge.

All high pressure ducts shall have Pittsburgh lock longitudinal seams.

C. Ducts exposed to water shall be sloped so rainwater will not stand on top of duct.

D. Strap hanger shall be a minimum of 1 inch, #18 gauge galvanized steel attached to the bottom of ducts at 8'- 0" OC and as required by CMC/UMC and SMACNA guidelines.

E. Elbows shall be radius or short radius with vanes, type RE 1 and RE 3 in the SMACNA manual. Mitered elbows with turning vanes and other types shall not be used. Construct vanes per pages A.41 and A.43 of the SMACNA manual.

F. Divided flow branches shall be per SMACNA manual figure 2-5, type 1 or type 4A or 4B only.

G. Branch connections per SMACNA manual figure 2-6; 45-degree entry shall only be used where airflow in branch is less than 25% of total airflow in main duct.

H. Offsets shall be SMACNA manual figure 2-7, type 3 only.

I. Bellmouth transitions shall be used on connections to air handling units and plenums.

J. Provide Ductmate and Ductmate, Jr. with all required material including metal cleats, corner bolts and nuts, angles, clips and gaskets, all installed in accordance with manufacturer's recommendations and supervision.

K. Quadrant volume damper blades in fittings shall be two gauges heavier than the fittings.

L. Longitudinal Seams: Pittsburgh lock sealed with non-curing polymer sealant. Button punch snap lock seams are not acceptable and shall not be used.

M. Provide drive slip or equivalent flat seams for ducts exposed in the conditioned space or where necessary due to space limitations.

N. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches and larger and 0.0359-inch-thick or less, with more than 10 sq. ft. of non-braced panel area unless ducts are lined.

O. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

P. Provide standard 45-degree lateral wye takeoffs. When space does not allow 45-degree lateral wye takeoff, use 90-degree conical tee connections.

2.05 RECTANGULAR DUCT FABRICATION

A. Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" and complying with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals except as modified by this specification.

1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure class.

2. Deflection: Duct systems shall not exceed deflection limits according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

B. Ducts exposed to water shall be sloped so rainwater will not stand on top of duct.

C. Elbows shall be radius or short radius with vanes, type RE 1 and RE 3 in the SMACNA manual. Mitered elbows with turning vanes and other types shall not be used. Construct vanes per pages A.41 and A.43 of the SMACNA manual.

D. Divided flow branches shall be per SMACNA manual figure 2-5, type 1 or type 4A or 4B only.

E. Branch connections per SMACNA manual figure 2-6; 45-degree entry shall only be used where airflow in branch is less than 25% of total airflow in main duct.

F. Offsets shall be SMACNA manual figure 2-7, type 3 only.

G. Bell-mouth transitions shall be used on connections to air handling units and plenums.

H. Transverse Joints: Prefabricated slide-on joints and components constructed using manufacturer's guidelines for material thickness, reinforcement size and spacing, and joint reinforcement.

1. Manufacturers:
   a. TDC

b. Ductmate Industries, Inc.
c. Nexus Inc.
d. Or equal.

I. Longitudinal Seams: Pittsburgh lock sealed with non-curing polymer sealant. Button punch snap lock seams are not acceptable to the University and shall not be used.

J. Provide drive slip or equivalent flat seams for ducts exposed in the conditioned space or where necessary due to space limitations.

K. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches and larger and 0.0359 inch thick or less, with more than 10 sf of non-braced panel area unless ducts are lined.

2.06 ROUND DUCT AND FITTING FABRICATION

A. Round, Spiral Lock-Seam Ducts: Fabricate supply ducts of galvanized steel according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

B. Ducts exposed to water shall be slopped so rainwater will not stand on top of duct.

C. Manufacturers: ECO Products or equal.

D. Duct Joints:
1. Ducts up to 20 Inches in Diameter: Interior, center-beaded slip coupling, sealed before and after fastening, attached with sheet metal screws.
2. Ducts 21 to 72 Inches in Diameter: Three-piece, gasketed, flanged joint consisting of two internal flanges with sealant and one external closure band with gasket.
3. Round Ducts: Prefabricated connection system consisting of double-lipped, EPDM rubber gasket. Manufacture ducts according to connection system manufacturer's tolerances.
4. Manufacturers: ECO Products or equal.

E. 90-Degree Tees and Laterals and Conical Tees: Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," with metal thicknesses specified for longitudinal-seam straight ducts.

F. Diverging-Flow Fittings: Fabricate with reduced entrance to branch taps and with no excess material projecting from fitting onto branch tap entrance.

G. Fabricate elbows using 5-gored construction. Bend radius of gored elbows shall be 1-1/2 times duct diameter. Unless elbow construction type is indicated, fabricate elbows as follows:
1. Welded Radius and Number of Pieces: Welded construction complying with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.
2. Round Elbows 8 Inches and Less in Diameter: Fabricate adjustable gored long radius for elbows.
3. Round Elbows 9 through 14 Inches in Diameter: Fabricate adjustable gored elbows. Fabricate 90 degrees elbows with minimum of 5 pieces.

4. Round Elbows Larger than 14 Inches in Diameter and All Flat-Oval Elbows: Fabricate gored elbows.
5. Die-Formed Elbows for Sizes through 8 Inches in Diameter and All Pressures 0.040 inch thick (20 ga) with 2-piece welded construction.
6. Round Gored-Elbow Metal Thickness: Same as non-elbow fittings specified above.
7. Flat-Oval Elbow Metal Thickness: Same as longitudinal-seam flat-oval duct specified above.

2.07 DUCT SEALANT MATERIALS

A. Joint and Seam Sealants, General: The term "sealant" is not limited to materials of adhesive or mastic nature but includes tapes and combinations of open-weave fabric strips and mastics.

B. Tape Sealing System: Woven-fiber tape impregnated with gypsum mineral compound and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.

C. Water-Based Joint and Seam Sealant: Flexible, adhesive sealant, resistant to UV light when cured, UL 181 listed; passes UL 723 for flame spread and smoke development; and complying with NFPA requirements for Class 1 ducts.

D. Flanged Joint Mastic: One-part, acid-curing, silicone, elastomeric joint sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.

E. Flange Gaskets: Butyl rubber or EPDM polymer with polyisobutylene plasticizer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify sizes of equipment connections before fabricating transitions.

3.02 INSTALLATION

A. Install and seal ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, as required in this section.

B. During construction, install temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

C. Use beaded sleeve couplings for joining round duct and flexible ducts.

D. Install duct hangers and supports in accordance with Section 23 05 29.

E. Use double nuts and lock washers on threaded rod supports.

3.03 INSTALLATION OF METAL DUCTWORK

A. General: Assemble and install ductwork in accordance with recognized industry practices which will achieve air-tight (5% total system leakage for systems rated 3 inch

and under; 1% total system for systems rated over 3 inch) and noiseless (no objectionable noise) systems capable of performing each indicated service. Install each run with a minimum number of joints. Align ductwork accurately at connections, within 1/8 inch misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers and anchors of type which will hold ducts true-to-shape and to prevent buckling. Support vertical ducts at every floor.

B. Field Fabrication: Complete fabrication of work at project as necessary to match shop fabricated work and accommodate installation requirements.

C. Routing: Locate ductwork runs, except as otherwise indicated, vertically and horizontally and avoid diagonal runs wherever possible. Locate runs as indicated by diagrams, details and notations or, if not otherwise indicated, run ductwork in shortest route which does not obstruct useable space or block access for servicing building and its equipment. Hold ducts close to walls, overhead construction, column, and other structural and permanent enclosure elements of building. Limit clearance to 1/2 inch where furring is shown for enclosure or concealment of ducts, but allow for insulation thickness, if any. Where possible, locate insulated ductwork for 1 inch clearance outside of insulation. Wherever possible in finished and occupied spaces, conceal ductwork from view, by locating in mechanical shafts, hollow wall construction or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown. Coordinate layout with suspended ceiling and lighting layouts and similar finished work.

D. Coordination: Coordinate duct installations with installation of accessories, dampers, coil frames, equipment, controls and other associated work of ductwork system.

E. Tape the clips, Snaplock seams and joints or connections of the metal supply, return and exhaust ducts and the grilled and diffuser connections with 4 inch strips of 6 oz. canvas attached with Arabol or Hardcast adhesive. Tape the filter frames the same as ducts. Coat all canvas exposed to the weather with Tuff Bond #12, Design Polymerics or equal. Taping of Pittsburgh seams is required. Use of water based duct sealant is acceptable.

F. Install access doors to open against system air pressure, with latches operable from either side, except outside only where duct is too small for person to enter.

G. Coordinate with other work, including ductwork, as necessary to interface installation of ductwork accessories properly with other work.

H. Round ducts shall be used to the maximum extent possible. As duct size increases, flat oval shall be considered. Rectangular ducts shall be limited to areas of space restriction with a maximum aspect ratio of 2:1. If due to a structural clearance constraint, duct aspect ratio can be increased and/or duct cross section reduced if upstream transition has included angles of 60 degrees or less and downstream transition has included angles of 30 degrees or less.

I. Ducts exposed outside to elements shall only be of round construction to shed rainwater. If conditions do not allow round ducts, provisions shall be provided to slope the flat top of rectangular ductwork so rainwater will not stand on top of duct.

J. Except for connection of terminal discharge duct to air outlets, 90 degree taps shall not be used unless space prohibits the use of low loss fittings. Takeoff feeding terminals shall be conical branch; 45 wye, conical branch; low loss tee; bell mouth, or branch with a loss coefficient equivalent to that for the conical branch. The slopes of transitions shall be approximately one to five, and no abrupt changes or offsets of any kind in the duct system shall be permitted.

K. Install round ducts in lengths not less than 12 feet unless interrupted by fittings.

L. Install ducts with fewest possible joints.

M. Install fabricated fittings for changes in directions, size, and shape and for connections.

N. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 12 inches, with a minimum of 3 screws in each coupling.

O. Install ducts vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs in ducts that would be over 12 feet in length.

P. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

Q. Install ducts with a clearance of 2 inch on each side, plus allowance for insulation thickness.

R. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.

S. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.

T. Seal all joints and seams. If specification requires duct pressure test then water based duct sealant can be used instead of canvas and Arabol. Apply sealant to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws.

U. Install heavy volume dampers at all main supply, return and exhaust duct branch connections or as indicated on the drawings. Heavy volume dampers shall be Pottorff Series 400 AF or Ruskin CD50, with handle, or equal.

V. Duct hangers shall be attached to horizontal slabs with steel angle clips secured with inserts, strapped to vertical walls, bolted to beams and joists, as per SMACNA guidelines, or as approved by the Engineer.

W. All ducts and equipment shall be blown out prior to operating.

X. Electrical Equipment Spaces: Route ducts to avoid passing through transformer vaults and electrical equipment spaces and enclosures and telephone equipment rooms.

Y. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls and are exposed to view, conceal spaces between construction openings and ducts or duct insulation with sheet metal flanges of same metal thickness as ducts. Overlap openings on 4 sides by at least 1-1/2 inches.

Z. Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire dampers or combination fire/smoke dampers, sleeves.

AA. Install ducts with hangers and braces designed to withstand, without damage to equipment, seismic force required by California building codes.

BB. Protect duct interiors from the elements and foreign materials until building is enclosed. Follow SMACNA's "Duct Cleanliness for New Construction."

CC. Do not paint interiors of metal ducts.

DD. Protect duct openings from damage and prevent entrance of foreign materials.

3.04 INSTALLATION OF FLEXIBLE DUCTS

A. Maximum length: For any duct run using flexible ductwork, do not exceed 7'- 0" extended length.

B. Installation: Install in accordance with Section III of SMACNA's "HVAC Duct Construction Standards, Metal and Flexible", latest edition.

C. Bends in flexible ducts shall have a radius of not less than 1.5 times the internal diameters.

3.05 EQUIPMENT CONNECTIONS

A. General: Connect metal ductwork to equipment as indicated. Provide flexible connection for each ductwork connection to equipment mounted on vibration isolators, and/or equipment containing rotary machinery. Provide access doors as indicated.

3.06 HANGING AND SUPPORTING

A. Support horizontal ducts within 24 inches of each elbow and within 48 inches of each branch intersection.

B. Support vertical ducts at maximum intervals of 16 feet and at each floor.

C. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load. Wire and friction clamps shall not be used.

D. Install concrete inserts before placing concrete.

E. Install drilled in concrete anchors after concrete is placed and completely cured.

F. Do not use powder-actuated concrete fasteners.

3.07 INTERFACE WITH OTHER PRODUCTS

A. Install openings in ductwork where required to accommodate thermometers and controllers. Install Pitot tube openings for testing of systems. Install Pitot tube complete with metal can with spring device or screw to prevent air leakage. Where openings are provided in insulated ductwork, install insulation material inside metal ring.

B. Connect diffusers to low pressure ducts directly or with 5 to 7 feet maximum length of flexible duct held in place with strap or clamp except as otherwise shown on the drawings. Do not use flexible duct on moisture laden air systems and exposed to view ductwork.

C. Connect air terminal units to supply ducts directly with at least one duct size larger than air terminal connection, except as shown otherwise on the drawings.

3.08 CLEANING NEW SYSTEM

A. If the ductwork system is maintained in a clean state during the installation the following is not required. If in the opinion of the Authority's Representative the ductwork system is dirty the following shall be complied with.

B. Mark position of dampers and air-directional mechanical devices before cleaning, and perform cleaning before air balancing.

C. Use service openings, as required, for physical and mechanical entry and for inspection.

D. Create other openings to comply with duct standards.

E. Disconnect flexible ducts as needed for cleaning and inspection.

F. Remove and reinstall ceiling sections to gain access during the cleaning process.

G. Vent vacuuming system to the outside. Include filtration to contain debris removed from HVAC systems, and locate exhaust down wind and away from air intakes and other points of entry into building.

H. Clean the following metal duct systems by removing surface contaminants and deposits:
   1. Air outlets and inlets (registers, grilles, and diffusers).
   2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
   3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
   4. Coils and related components.
   5. Return-air ducts, dampers, and actuators except in ceiling plenums and mechanical equipment rooms.
   6. Supply-air ducts, dampers, actuators, and turning vanes.

I. Cleaning Requirements:
   1. Interior surfaces of all supply ductwork shall be cleaned of dust and dirt at the fabrication shop during fabrication.
   2. Supply Ductwork shall be sealed to protect interior surfaces prior to being shipped and handled.
   3. Seals and wrapping shall be removed on job site at time of installation.
   4. Seal open duct ends during at the end of each day.

J. Mechanical Cleaning Methodology:
   1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
   2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
   3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
   4. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.

K. Cleanliness Verification:
   1. Visually inspect metal ducts for contaminants.
   2. Where contaminants are discovered, re-clean and re-inspect ducts.

3.09 SCHEDULES

A. Static-Pressure Classes: Construct ducts according to the following:
   1. Supply Ducts: 4-inch wg.
   2. Return Ducts (Negative Pressure): 2-inch wg.
   3. General Exhaust Ducts (Negative Pressure): 2-inch wg.

END OF SECTION

SECTION 23 33 00

AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Back-draft dampers.
   2. Combination fire-and-smoke dampers.
   3. Duct access doors.
   4. Volume control dampers.
   5. Flexible duct connections.
   6. Duct test holes.

B. Related Sections:
   1. Section 23 31 00 - HVAC Ducts and Casings
   2. Division 26: Equipment Wiring Connections

1.02 REFERENCES

A. Air Movement and Control Association International, Inc.:
   1. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.

B. ASTM International:
   1. ASTM E1 - Standard Specification for ASTM Thermometers.

C. National Fire Protection Association:
   1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
   2. NFPA 92A - Recommended Practice for Smoke-Control Systems.

D. Sheet Metal and Air Conditioning Contractors:
   1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

E. Underwriters Laboratories Inc.:
   1. UL 555 - Standard for Safety for Fire Dampers.
   2. UL 555C - Standard for Safety for Ceiling Dampers.
   3. UL 555S - Standard for Safety for Smoke Dampers.

1.03 SUBMITTALS

A. Refer to Section 01 30 00 Submittals, for submittal requirements.

B. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers, duct access doors and duct test holes.

C. Product Data: Submit data for shop fabricated assemblies and hardware used.

D. Product Data: Submit for the following. Include where applicable electrical characteristics and connection requirements.
   1. Fire dampers including locations and ratings.
   2. Smoke dampers including locations and ratings.
   3. Backdraft dampers.
   4. Flexible duct connections.
   5. Volume control dampers.
   6. Duct access doors.
   7. Duct test holes.

E. Product Data: For fire dampers, smoke dampers, combination fire and smoke dampers submit the following:
   1. Include UL ratings, California State Fire Marshal approval and NFPA 90A, dynamic ratings, leakage, pressure drop and maximum pressure data.
   2. Indicate materials, construction, dimensions, and installation details.
   3. Damper pressure drop ratings based on tests and procedures performed in accordance with AMCA 500.

F. Manufacturer's Installation Instructions: Submit for Fire and Combination Smoke and Fire Dampers.

G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

H. Acceptance or no exceptions taken by the engineer on any substitution proposed by the contractor shall not be construed as relieving the contractor from compliance with the project's specifications and performance requirements nor departure there from. The contractor remains responsible for details and accuracy for confirming and correlating quantities and dimensions and for the selection of fabrication processes, techniques and assembly, coordination of his work with that of all other trades and making any needed modifications consequent to the substitution at his own cost and for performing the work in a safe manner.

1.04 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of access doors, test holes and combination smoke/fire dampers.

B. Operation and Maintenance Data: Submit for Combination Smoke and Fire Dampers.

1.05 QUALITY ASSURANCE

A. Dampers tested, rated and labeled in accordance with the latest UL requirements.

B. Damper pressure drop ratings based on tests and procedures performed in accordance with AMCA 500.

C. Maintain one copy of each document on site.

1.06 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.07 PRE-INSTALLATION MEETINGS

A. Convene minimum three weeks prior to commencing work of this section.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

B. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material.

C. Storage: Store materials in a dry area indoor, protected from damage.

D. Handling: Handle and lift dampers in accordance with manufacturer's instructions. Protect materials and finishes during handling and installation to prevent damage.

1.09 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.10 COORDINATION

A. Coordinate Work where appropriate with building control Work.

PART 2 - PRODUCTS

2.01 BACK-DRAFT DAMPERS

A. Manufacturers:
   1. Pottorff
   2. Ruskin
   3. Greenheck
   4. Or equal.

B. Product Description: Multi-Blade, back-draft dampers: Parallel-action, gravity-balanced, extruded aluminum. Blades, maximum 6 inch width, with felt or flexible vinyl sealed edges. Blades linked together in rattle-free manner with 90-degree stop, steel ball bearings, and plated steel pivot pin. Furnish dampers with adjustment counter balance weight to permit setting for varying differential static pressure. Back draft damper shall be capable of adjusting to 0.025 inches of water pressure.

2.02 COMBINATION FIRE AND SMOKE DAMPERS / FIRE DAMPERS

A. Manufacturers:
   1. Pottorff
   2. Ruskin

3. Greenheck
4. Or equal.

B. Furnish and install California State Fire Marshal approved combination smoke/fire dampers where shown on plans. The dampers shall meet all the requirements for smoke dampers per the latest edition of NFPA 90A and UL standards. Combination fire and smoke dampers shall be louver bladed type. Rating 1-1/2 hours for installation in one or two-hour partitions. The units will incorporate a low friction design that provides overlapping. The blade edge seals will be silicone and provide a minimum Class 2 seal at 350 degrees as per UL 555S. The damper shall be capable of being remotely controlled and reset for pressurization and smoke evacuation. The fire releasing device will be a UL 33 listed HS10. Provide PI50 end switch and wire to RCP-1 (remote control panel) mounted on ceiling below respective fire smoke damper. The fire releasing device must also be listed by the CSFM for use with the damper assembly. Melting fusible links are not acceptable. The dampers shall be provided in sleeves with pre-mounted motor actuators and dual position indicators for remote annunciation. The damper must be able to fail open or close for smoke, depending on the system requirements. The motors must be Belind FSLF120 or FSLF24 and have a minimum 5-year warranty. The motors must be mounted on a bracket that allows for use of slip joint connections or "Duct-mate" type connections without modification. The complete assembly must be factory cycled and tested prior to shipment. Provide suitable access for inspection and servicing of each damper. All smoke/fire dampers shall be tested by the Contractor in the presence of the field inspector and the State Fire Marshal. This test shall be performed prior to the installation of the ceilings.

C. Fire dampers shall be Pottorff VFD dynamic curtain fire damper or equivalent by Ruskin or Air Balance, sized to maintain full duct area at the fire dampered opening, installed at the location indicated and provided where required by NFPA 90A or Code and shall have CSFM's listing number. Fire damper shall be curtain type with blades removed from the air stream to allow for maximum free area. Dampers will be provided in factory sleeves as tested and listed by manufacturer. Dampers shall be rated for 1 1/2 hours for installation in one or two-hour partitions. Provide UL listed fusible links of adequate size and temperature rating. Dampers to be installed according to the manufacturers recommended installation instructions provided with units. Provide suitable access for inspection and servicing of each damper.

2.03 DUCT ACCESS DOORS

A. Manufacturers:
1. Air Balance, Inc.
2. Duro Dyne Corp.
3. Register & Grille Mfg. Co., Inc.
4. Ruskin Mfg. Co.
5. Ventfabrics, Inc.
6. Zurn Industries, Inc.; Air Systems Div.
7. Or equal.

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated on Drawings.

C. Construction: Construct of same or greater gage as ductwork served, provide insulated doors for insulated ductwork. Provide flush frames for uninsulated ductwork, extended frames for externally insulated duct. Provide one side hinged other side with one handle type latch for doors 12-inch-high and smaller, 2 handle type latches for larger doors.

2.04 VOLUME CONTROL DAMPERS

A. Manufacturers:
   1. Ventfabrics, Inc.
   2. Young Regulator Co.
   3. Duro Dyne Corp.
   4. Or equal.

B. General Description: Factory fabricated, with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.
   1. Pressure Classes of 3-Inch wg or Higher: End bearings or other seals for ducts with axle's full length of damper blades and bearings at both ends of operating shaft.

C. Standard Volume Dampers: Multiple-opposed-blade design, standard leakage rating, with linkage outside air stream, and suitable for horizontal or vertical applications. Single blade design may be used for duct sizes 12" and smaller.
   1. Steel Frames: Hat-shaped, galvanized (provide stainless in outside air system) sheet steel channels, minimum of 0.064-inch-thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
   2. Roll-Formed Steel Blades: 0.064-inch- thick, galvanized (provide stainless in outside air system) sheet steel.
   3. Blade Axles: Stainless steel.
   4. Bearings: Stainless-steel sleeve.
   5. Tie Bars and Brackets: Galvanized steel.

D. Low-Leakage Volume Dampers for fume hoods and similar installations: Multiple- or single-blade, parallel- or opposed-blade design low-leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.
   1. Steel Frames: stainless sheet steel channels, minimum of 0.064-inch-thick, with mitered and welded corners; frames with flanges for attaching to walls and flangeless frames for installing in ducts.
   2. Roll-Formed Steel Blades: 0.064-inch- thick, stainless sheet steel.
   3. Blade Axles: Stainless steel.
   4. Bearings: Stainless-steel sleeve thrust or ball.
   5. Blade Seals: Neoprene.

E. Jamb Seals: Cambered stainless steel Jack shaft: 1-inch- diameter, galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
   1. Length and Number of Mountings: Appropriate to connect linkage of each damper in multiple-damper assembly.

F. Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch-thick zinc-plated steel, and a 3/4-inch hexagon locking nut. Include center hole to suit damper operating-rod size. Include elevated platform for insulated duct mounting.

2.05 FLEXIBLE DUCT CONNECTIONS

A. Manufacturers:
1. Duro Dyne Corp.
2. Ventfabrics, Inc.
3. Or equal.

B. General Description: Flame-retardant or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.

C. Metal-Edged Connectors: Factory fabricated with a fabric strip 5-3/4 inches wide attached to two strips of 2-3/4-inch- wide, 0.028-inch- thick (24 ga), galvanized sheet steel or 0.032-inch- thick aluminum sheets. Select metal compatible with ducts.

D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
1. Minimum Weight: 26 oz. /sq. yd.
2. Tensile Strength: 480 lbf/inch in the warp and 360 lb/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

E. Outdoor System, Flexible Connector Fabric: Glass fabric insulated double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
1. Minimum Weight: 24 oz. /sq. yd.
2. Insulation: Fiberglass.
3. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
4. Service Temperature: Minus 50 to plus 250 deg F.

F. High-Temperature System, Flexible Connectors: Glass fabric coated with silicone rubber.
1. Minimum Weight: 16 oz. /sq. yd.
2. Tensile Strength: 285 lbf/inch in the warp and 185 lbf/inch in the filling.
3. Service Temperature: Minus 67 to plus 500 deg F.

G. High-Corrosive-Environment System, Flexible Connectors: Glass fabric with chemical-resistant coating.
1. Minimum Weight: 14 oz. /sq. yd.
2. Tensile Strength: 450 lbf/inch in the warp and 340 lbf/inch in the filling.
3. Service Temperature: Minus 67 to plus 500 deg F.

2.06 SCREENS

A. Screens shall be 1-inch mesh, 12 gauge stainless steel wire set in 1 inch galvanized channel frames for all openings.

2.07 DUCT HARDWARE

A. General: Provide duct hardware, manufactured by one manufacturer for all items on project, for the following:

1. Test holes: Provide in ductwork at fan inlet and outlet, and elsewhere as indicated, duct test holes, consisting of slot and cover, for instrument tests.
2. Quadrant locks: Provide for each damper, quadrant lock device on one end of shaft; and end bearing plate on other end for damper lengths over 12 inches. Provide extended quadrant locks and end extended bearing plates for externally insulated ductwork.

B. Manufacturer: Subject to compliance with requirements, provided duct hardware of one of the following:
1. Ventfabrics, Inc.
2. Young Regulator Co.
3. Duro Dyne
4. Or equal.

2.08 TURNING VANES

A. Square throat elbow with vanes not allowed. Provide short radius elbows with vanes per SMACNA details as indicated on the drawings.

2.09 DUCT MOUNTING ACCESS DOORS

A. General Description: Fabricate doors airtight and suitable for duct pressure class.

B. Door: Double wall, duct mounting and rectangular, fabricated of galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class. Include vision panel where indicated. Include 1-by1-inch butt or piano hinge and cam latches.
1. Manufacturers:
   a. American Warming and Ventilating
   b. Ductmate Industries, Inc.
   c. Ward Industries, Inc.
   d. Or equal.
2. Frame: Galvanized sheet steel with bend-over tabs and foam gaskets.
3. Provide number of hinges and locks as follows:
   a. Less than 12 Inches Square: Secure with one sash lock.
   b. Up to 18 Inches Square: Two hinges and two sash locks.
   c. Up to 24 by 48 inches: Three hinges and two compression latches with outside and inside handles.
   d. Sizes 24 by 48 inches and Larger: Four hinges and two compression latches with outside and inside handles

C. Door: Double wall, duct mounting, round; fabricated of galvanized sheet metal with insulation fill and 1 inch thickness. Include knobs.
1. Manufacturers:
   a. American Warming and Ventilating
   b. Ductmate Industries, Inc.
   c. Ward Industries, Inc.
   d. Or equal.

D. Frame: Galvanized sheet steel with spin-in notched frame.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify rated walls are ready for fire damper installation.

B. Verify ducts and equipment installation are ready for accessories.

C. Check location of air outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

3.02 INSTALLATION.

A. Install in accordance with NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 23 31 00 for duct construction and pressure class.

B. Provide a volume control for each grille and diffuser and in all other locations necessary to properly balance the system.

C. Quadrants on insulated ducts shall be mounted on sheet metal brackets, set flush with the insulation.

D. Install back-draft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated on Drawings. Back draft dampers are not required for the fans with continuous operation and kitchen exhaust fans.

E. Access Doors: Install access doors at the following:
   1. Spaced every 50 feet of straight duct.
   2. Adjacent to each duct mounted filter.
   3. Adjacent to each duct mounted coil.
   4. Before and after each duct mounted fan.
   5. Adjacent to each fire damper, smoke damper and combination fire and smoke damper.
   6. Install at locations for cleaning kitchen exhaust ductwork in accordance with NFPA 96.

F. Access Door Sizes: Install minimum 8 x 8-inch size for hand access, 18 x 18 inch size for shoulder access. Review locations prior to fabrication.

G. Install the following sizes for duct-mounting, round access doors:
   1. 8 inches in diameter for up to 12-inch diameter duct size.
   2. 12 inches in diameter for 13-inch to 19-inch duct sizes.
   3. 18 inches in diameter for 20-inch to 25-inch duct sizes.
   4. 24 inches in diameter for larger duct sizes than listed above.

H. Label access doors according to Division 23.

I. Install temporary duct test holes required for testing and balancing purposes. Cut or drill in ducts. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

J. Install fire dampers, combination fire and smoke dampers and smoke dampers at locations as indicated on Drawings. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.
   1. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92A.
   2. Install dampers square and free from racking with blades running horizontally.
   3. Do not compress or stretch damper frame into duct or opening.
   4. Handle damper using sleeve or frame. Do not lift damper using blades, actuator, or jack shaft.
   5. Install bracing for multiple section assemblies to support assembly weight and to hold against system pressure. Install bracing as needed.

K. Install flexible connectors immediately adjacent to equipment in ducts associated with fans and motorized equipment supported by vibration isolators.

L. For fans developing static pressures of 5-inch wg and higher, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

M. Connect flexible ducts to metal ducts with adhesive and draw bands.

N. Provide instrument test holes in ductwork at fan inlets and outlets and elsewhere as required by Testing, Adjusting and Balancing Contractor for testing and balancing purposes.

END OF SECTION

SECTION 23 34 00

HVAC FANS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Ceiling Fans.
   2. Gravity Intake Ventilator

B. Related Sections:
   1. Section 23 07 00 - HVAC Insulation.
   2. Section 23 31 00 - HVAC Ducts and Casings
   3. Section 23 33 00 - Air Duct Accessories
   4. Division 26 - Equipment Wiring Connections

1.02 REFERENCES

A. American Bearing Manufacturers Association:
   1. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
   2. ABMA 11 - Load Ratings and Fatigue Life for Roller Bearings.

B. Air Movement and Control Association International, Inc.:
   1. AMCA 99 - Standards Handbook.
   2. AMCA 204 - Balance Quality and Vibration Levels for Fans.
   3. AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
   4. AMCA 300 - Reverberant Room Method for Sound Testing of Fans.
   5. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

C. American Refrigeration Institute:
   1. ARI 1060 - Air-to-Air Energy Recovery Ventilation Equipment Certification Equipment Program.

D. National Electrical Manufacturers Association:
   1. NEMA MG 1 - Motors and Generators.
   2. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

E. Underwriters Laboratories Inc.:
   1. UL 705 - Power Ventilators.

1.03 SUBMITTALS

A. Refer to Section 01 30 00 Submittals, for submittal requirements.

B. Shop Drawings: Indicate size and configuration of fan assembly, mountings, weights, ductwork and accessory connections.

C. Product Data: Submit data on each type of fan and include accessories, fan curves with specified operating point plotted, power, RPM, sound power levels for both fan inlet and outlet at rated capacity, electrical characteristics and connection requirements.

D. Manufacturer's Installation Instructions: Submit fan manufacturer’s instructions.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

F. Acceptance or no exceptions taken by the engineer on any substitution proposed by the contractor shall not be construed as relieving the contractor from compliance with the project's specifications and performance requirements nor departure there from. The contractor remains responsible for details and accuracy for confirming and correlating quantities and dimensions and for the selection of fabrication processes, techniques and assembly, coordination of his work with that of all other trades and making any needed modifications consequent to the substitution at his own cost and for performing the work in a safe manner.

1.04 CLOSEOUT SUBMITTALS

A. Refer to Section 01 30 00 Submittals, for submittal requirements.

B. Operation and Maintenance Data: Submit instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.05 QUALITY ASSURANCE

A. Performance Ratings: Conform to AMCA 210 and bear AMCA Certified Rating Seal.

B. Sound Ratings: AMCA 301, tested to AMCA 300, and bear AMCA Certified Sound Rating Seal.

C. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.

D. Balance Quality: Conform to AMCA 204.

1.06 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.07 PRE-INSTALLATION MEETINGS

A. Convene minimum one week prior to commencing work of this section.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Protect motors, shafts, and bearings from weather and construction dust.

1.09 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.10 EXTRA MATERIALS

A. Furnish two sets of belts for each fan.

PART 2 - PRODUCTS

2.01 CEILING FANS

A. Manufacturer:
   1. Cook Co., Loren

B. General: Except as otherwise indicated, provide standard prefabricated ceiling fans of type and size indicated, modified as necessary to comply with requirements, and as required for complete installation.

C. Centrifugal Fan Unit: Direct driven with injection molded resin housing, resilient mounted motor, gravity backdraft damper in discharge opening, integral outlet duct collar.

D. Disconnect Switch: Cord and plug in housing for thermal overload protected motor.

E. Grille: Molded white plastic.

F. Wheel: Centrifugal forward curved type constructed of injection molded or polypropylene resin.

G. Motor: Open drip proof type with permanently lubricated sealed bearings and thermal overload protection.

H. Accessories:
   1. Roof cap with birdscreen.
   2. See schedule in plans.

2.02 GRAVITY INTAKE VENTILATOR

A. Manufacturer:
   1. Cook Co., Loren

B. Description: Unit shall be hooded high-efficiency, roof-mounted gravity intake ventilator.

C. Construction: The unit shall be of bolted and welded construction utilizing corrosion-resistant fasteners. The hood shall be constructed of minimum 18-gauge aluminum or 20-gauge galvanized steel, bolted to a minimum 8-gauge aluminum or 12-gauge galvanized steel support structure. A radius throat must be provided to help prevent damage from improper lifting. The base shall have continuously welded curb cap corners for maximum leak protection. Birdscreen constructed of 1/2” galvanized mesh

shall be mounted in the hood. Unit shall bear an engraved aluminum nameplate. Nameplate shall indicate design CFM and static pressure.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install flexible connections between fan and ductwork. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.

B. Install backdraft dampers on outlet from ceiling fans.

3.02 MANUFACTURER'S FIELD SERVICES

A. Furnish services of factory trained representative for minimum of one day to start-up, calibrate controls, and instruct Authority on operation and maintenance.

3.03 CLEANING

A. Division 01 - Execution and Closeout Requirements: Requirements for cleaning.

B. Vacuum clean coils and inside of fan cabinet.

3.04 DEMONSTRATION

A. Refer to Section 01 30 00 Submittals, for submittal requirements.

B. Demonstrate fan operation and maintenance procedures.

3.05 PROTECTION OF FINISHED WORK

A. Refer to Section 01 30 00 Submittals, for submittal requirements.

B. Do not operate fans for until ductwork is clean, bearings lubricated, and fan has been test run under observation.

END OF SECTION

SECTION 23 37 00

AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Diffusers.
   2. Registers
   3. Grilles.

B. Related Sections:
   1. Section 09 90 00 - Painting and Coating: Execution and product requirements for Painting of ductwork visible behind outlets and inlets specified by this section.
   2. Section 23 33 00 - Air Duct Accessories: Volume dampers for inlets and outlets.

1.02 REFERENCES

A. Air Movement and Control Association International, Inc.:
   1. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.

B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
   1. ASHRAE 70 - Method of Testing for Rating the Performance of Air Outlets and Inlets.

C. Sheet Metal and Air Conditioning Contractors:
   1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

1.03 SUBMITTALS

A. Refer to Section 01 30 00 Submittals, for submittal requirements.

B. Product Data: Submit sizes, finish, and type of mounting. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

C. Test Reports: Rating of air outlet and inlet performance.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

E. Acceptance or no exceptions taken by the engineer on any substitution proposed by the contractor shall not be construed as relieving the contractor from compliance with the project's specifications and performance requirements nor departure there from. The contractor remains responsible for details and accuracy for confirming and correlating quantities and dimensions and for the selection of fabrication processes, techniques and assembly, coordination of his work with that of all other trades and making any needed modifications consequent to the substitution at his own cost and for performing the work in a safe manner.

1.04 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of air outlets and inlets.

1.05 QUALITY ASSURANCE

A. Test and rate diffuser, register, and grille performance in accordance with ASHRAE 70 and ADC 1062 “Certification, Rating and Test Manual”.

B. Test and rate louver performance in accordance with AMCA 500.

C. NFPA Compliance: Install air outlets in accordance with NFPA 90A “Standard for the Installation of Air Conditioning and Ventilation Systems”.

1.06 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years documented experience.

1.07 PRE-INSTALLATION MEETINGS

A. Convene minimum one week prior to commencing work of this section.

1.08 EXTRA MATERIALS

A. Refer to Section 01 30 00 for requirements.

PART 2 - PRODUCTS

2.01 CEILING AIR DIFFUSERS, REGISTERS, AND GRILLES

A. Acceptable Manufacturers:
1. Titus
2. Price
3. Or equal.

B. General: Except as otherwise indicated, provide manufacturer's standard ceiling air diffusers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

C. Performance: Provide ceiling air diffusers that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.

D. Ceiling Compatibility: Provide diffusers with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems that will contain each type of ceiling air diffuser.

E. Types: Provide ceiling diffusers of type, capacity, and with accessories and finishes as listed on diffuser schedule. The following requirements shall apply to nomenclature indicated on schedule:

F. Finishes: Ceiling diffusers, registers and grilles: Semi-gloss white enamel prime finish.

G. Finish of sidewall outlets baked aluminum enamel or electroplated core and factory prime coated frame, as applicable to aluminum and steel respectively; ceiling outlets shall be factory finished white enamel unless otherwise specified. All outlets in shops and toilet rooms natural anodized aluminum or electroplated frame and core, as applicable to aluminum and steel respectively.

2.02 RETURN CEILING GRILLES

A. Acceptable Manufacturer:
1. Titus Model PAR-AA, all aluminum or approved equal.
2. Price
3. Or equal.

B. Finish: Baked enamel, White

C. Face Arrangement: ½ X ½ X ½ Inch Eggcrate Aluminum Core

D. Frame: 1 ¼” wide

E. Mounting: Surface mounted or Lay-in.

F. Provide filler panel when installed in 24” X 24” T-bar ceiling. Panel to match ceiling construction. For 24" x 48" T-bar ceilings, coordinate with ceiling installer for auxiliary tees as required to provide 24" x 24" space. Where full 24" x 24" grid module is not available, surface mount the outlet in center cut to fit ceiling tile.

G. Damper: None

2.03 CEILING SUPPLY DIFFUSERS

A. Acceptable Manufacturer: Titus Model TMS-AA, Price, or equal.

B. Material: All Aluminum

C. Finish: Baked enamel, White

D. Face Arrangement: Fixed louver blades, with four insert modules for adjustable throw pattern.

E. Pattern: Adjustable form 1-4 way throw.

F. Mounting: Surface mounted or Lay-in.

G. Provide filler panel when installed in 24” X 24” T-bar ceiling. Panel to match ceiling construction. For 24" x 48" T-bar ceilings, coordinate with ceiling installer for auxiliary

tees as required to provide 24" x 24" space. Where full 24" x 24" grid module is not available, surface mount the outlet in center cut to fit ceiling tile.

H. Damper: None

2.04 SUPPLY SIDE WALL GRILLES

A. Acceptable Manufacturer: Titus Model 300FL, Price, or equal.

B. Material: All Aluminum

C. Finish: Baked enamel, White

D. Face Arrangement: ¾ blade spacing Double Deflection Adjustable Airfoil Blades

E. Frame: 1 ¼" wide

F. Mounting: Side wall

G. Damper: None

PART 3 - EXECUTION

3.01 EXAMINATION

A. Refer to Section 01 30 00 Submittals, for submittal requirements.

B. Verify inlet and outlet locations.

C. Verify ceiling and wall systems are ready for installation.

3.02 INSTALLATION

A. Install diffusers to ductwork with airtight connection.

B. Install balancing dampers on duct take-off to diffusers, grilles, and registers, whether or not dampers are furnished as part of diffuser, grille, and register assembly. Refer to Division 23, Air Duct Accessories.

C. Paint visible portion of ductwork behind air outlets and inlets matte black. Refer to Division 09.

3.03 INTERFACE WITH OTHER PRODUCTS

A. Check location of outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

END OF SECTION

SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copper building wire rated 600 V or less.
2. Connectors, splices, and terminations rated 600 V and less.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: Indicate type, use, location, and termination locations.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

B. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. RoHS compliant.
3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

C. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 496 for stranded conductors.

D. Conductor Insulation:

1. Type NM: Comply with UL 83 and UL 719.

2. Type THHN and Type THWN-2: Comply with UL 83.
3. Type XHHW-2: Comply with UL 44.

2.2 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.

C. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.

1. Material: Copper.
2. Type: Two hole with long barrels.
3. Termination: Compression .

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

C. Power-Limited Fire Alarm and Control: Solid for No. 12 AWG and smaller.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type XHHW-2, single conductors in raceway.

B. Exposed Feeders: Type XHHW-2, single conductors in raceway feeders concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN/THWN-2, single conductors in raceway.

C. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.

D. Feeders in Cable Tray: Type THHN/THWN-2, single conductors in raceway or Type XHHW-2, single conductors larger than No. 1/0 AWG.

E. Branch Circuits Concealed in Ceilings, Walls, and Partitions:Type THHN/THWN-2, single conductors in raceway

F. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway or Type XHHW-2, single conductors in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches (300 mm) of slack.

3.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

END OF SECTION 260519

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes grounding and bonding systems and equipment, plus the following special applications:

1. Underground distribution grounding.
2. Foundation steel electrodes.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article.

B. Qualification Data: For testing agency and testing agency's field supervisor.

C. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1. Plans showing as-built, dimensioned locations of grounding features specified in "Field Quality Control" Article, including the following:

a. Test wells.
b. Ground rods.
c. Grounding arrangements and connections for separately derived systems.

2. Instructions for periodic testing and inspection of grounding features at test wells grounding connections for separately derived systems based on NETA MTS-2015.

a. Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
b. Include recommended testing intervals.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Certified by NETA.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.2 CONDUCTORS

A. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
5. Bonding Conductor: No. 4 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 8 inches in cross section, with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

2.3 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

C. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless exothermic-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

D. Bus-Bar Connectors: Compression type, copper or copper alloy, with two wire terminals.

E. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.

F. Cable-to-Cable Connectors: Compression type, copper or copper alloy.

G. Cable Tray Ground Clamp: Mechanical type, zinc-plated malleable iron.

H. Conduit Hubs: Mechanical type, terminal with threaded hub.

I. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.

J. Lay-in Lug Connector: Mechanical type, copper rated for direct burial terminal with set screw.

K. Service Post Connectors: Mechanical type, bronze alloy terminal, in short- and long-stud lengths, capable of single and double conductor connections.

L. Signal Reference Grid Clamp: Mechanical type, stamped-steel terminal with hex head screw.

M. Straps: Solid copper, copper lugs. Rated for 600 A.

N. Tower Ground Clamps: Mechanical type, copper or copper alloy, terminal two-piece clamp.

O. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.

P. Water Pipe Clamps:

1. Mechanical type, two pieces with stainless-steel bolts.

    a. Material: Die-cast zinc alloy.
    b. Listed for direct burial.

2. U-bolt type with malleable-iron clamp and copper ground connector rated for direct burial.

2.4 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel 3/4 inch by 10 feet (19 mm by 3 m.

B. Ground Plates: 1/4 inch (6 mm) thick, hot-dip galvanized.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 4/0 AWG minimum.

1. Bury at least 24 inches (600 mm) below grade.

C. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus horizontally, on insulated spacers 2 inches (50 mm) minimum from wall, 6 inches (150 mm) above finished floor unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

D. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches (100 mm) will extend above finished floor. If

necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches (50 mm) above to 6 inches (150 mm) below concrete. Seal floor opening with waterproof, nonshrink grout.

C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.

D. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches (150 mm) from the foundation.

3.4 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Armored cable runs.
8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

E. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.5 FENCE GROUNDING

A. Fence Grounding: Install at maximum intervals of 220 feet except as follows:

1. Fences within 100 Feet (30 m) of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 2205 m.

a. Gates and Other Fence Openings: Ground fence on each side of opening.

B. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a maximum distance of 150 feet (45 m) on each side of crossing.

3.6 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

C. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.

D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

E. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections with the assistance of a factory-authorized service representative.

B. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal[, at ground test wells. Make tests at ground rods before any conductors are connected.

    a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by fall-of-potential method according to IEEE 81.

4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

C. Grounding system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.

2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 2 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm.
5. Substations and Pad-Mounted Equipment: 5 ohms.
6. Manhole Grounds: 10 ohms.

F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 26 05 26

SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel slotted support systems.
2. Conduit and cable support devices.
3. Support for conductors in vertical conduit.
4. Structural steel for fabricated supports and restraints.
5. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.
6. Fabricated metal equipment support assemblies.

B. Related Requirements:

1. Section 260548.16 "Seismic Controls for Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. For fabrication and installation details for electrical hangers and support systems.

1. Hangers. Include product data for components.
2. Slotted support systems.
3. Equipment supports.
4. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

C. Delegated-Design Submittal: For hangers and supports for electrical systems.

1. Include design calculations and details of hangers.
2. Include design calculations for seismic restraints.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, and coordinated with each other, using input from installers of the items involved.

B. Seismic Qualification Data: Certificates, for hangers and supports for electrical equipment and systems, accessories, and components, from manufacturer.

C. Welding certificates.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M.
2. AWS D1.2/D1.2M.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Hangers and supports shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the supported equipment and systems will remain in place without separation of any parts when subjected to the seismic forces specified and the supported equipment and systems will be fully operational after the seismic event."
2. Component Importance Factor: 1.5.

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame Rating: Class 1.
2. Self-extinguishing according to ASTM D 635.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch- (10-mm-) diameter holes at a maximum of 8 inches (200 mm) o.c. in at least one surface.
1. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
2. Material for Channel, Fittings, and Accessories Stainless steel, Type 316.
3. Channel Width 1-5/8 inches (41.25 mm).
4. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
5. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
6. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.

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

B. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.

D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.

E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts:All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:

1. NECA 1.
2. NECA 101
3. NECA 105.

B. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.

C. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."

D. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, RGS as scheduled in NECA 1, where its Table 1 lists maximum spacings that are less than those stated in NFPA 70. Minimum rod size shall be 3/8 inch (8.4 mm) in diameter.

E. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps

F. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings, and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT and RGS may be supported by openings through structure members, according to NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.

4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that comply with seismic-restraint strength and anchorage requirements.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

END OF SECTION 26 05 29

SECTION 26 05 33 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal conduits and fittings.
2. Nonmetallic conduits and fittings.
3. Metal wireways and auxiliary gutters.
4. Nonmetal wireways and auxiliary gutters.
5. Surface raceways.
6. Boxes, enclosures, and cabinets.
7. Handholes and boxes for exterior underground cabling.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Structural members in paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

B. Seismic Qualification Data: Certificates, for enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal components, from manufacturer.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

A. Metal Conduit:

1. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. GRC: Comply with ANSI C80.1 and UL 6.
3. PVC-Coated Steel Conduit: PVC-coated **rigid steel conduit**.

    a. Comply with NEMA RN 1.
    b. Coating Thickness: 0.040 inch (1 mm), minimum.

4. EMT: Comply with ANSI C80.3 and UL 797.
5. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

B. Metal Fittings: Comply with NEMA FB 1 and UL 514B.
1. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Fittings, General: Listed and labeled for type of conduit, location, and use.
3. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
4. Fittings for EMT:

    a. Material: **Steel or die cast**.
    b. Type: **compression**.

5. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
6. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

C. Joint Compound for GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS AND FITTINGS

A. Nonmetallic Conduit:

B. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
1. RNC: **Type EPC-40-PVC** with NEMA TC 2 and UL 651 unless otherwise indicated.

C. Nonmetallic Fittings:
1. Fittings, General: Listed and labeled for type of conduit, location, and use.
2. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
3. Solvents and Adhesives: As recommended by conduit manufacturer.

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Description: Sheet metal, complying with UL 870 and NEMA 250**Type 3R** unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

2.4 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

A. Listing and Labeling: Nonmetallic wireways and auxiliary gutters shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Description: PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.

C. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.

D. Solvents and Adhesives: As recommended by conduit manufacturer.

2.5 BOXES, ENCLOSURES, AND CABINETS

A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, **ferrous alloy**, Type FD, with gasketed cover.

D. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

E. Metal Floor Boxes:

1. Material: **Cast metal**.
2. Type: **Fully adjustable**.
3. Shape: Rectangular.
4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.

G. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing 70 lb (32 kg).

1. Listing and labeling: Paddle fan outlet boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

H. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

I. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, **galvanized, cast iron** with gasketed cover.

J. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

K. Device Box Dimensions: **4 inches square by 2-1/8 inches deep (100 mm square by 60 m.** .

L. Gangable boxes are **prohibited**.

M. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, **Type 3R** with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Plastic.
3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

N. Cabinets:

1. NEMA 250, **Type 1** or **Type 3R (as indicated on plans)** galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.6 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. General Requirements for Handholes and Boxes:

1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.

2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.
1. Standard: Comply with SCTE 77.
2. Configuration: Designed for flush burial with **integral closed** bottom unless otherwise indicated.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, **"ELECTRIC."** or ”**COMMUNICATIONS**”.
6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: **GRC, RNC, Type EPC-40-PVC**.
2. Concealed Conduit, Aboveground: **GRC, EMT,MC (as reviewed by district)**.
3. Underground Conduit: RNC, **Type EPC-40-PVC CONCRETE ENCASED.**
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): **LFMC**.
5. Boxes and Enclosures, Aboveground: NEMA 250, **Type 3R**.

B. Indoors: Apply raceway products as specified below unless otherwise indicated.

- Exposed, Not Subject to Physical Damage: **GRC**.

1. Exposed, Not Subject to Severe Physical Damage: **GRC**.
2. Exposed and Subject to Severe Physical Damage: **GRC**]. Raceway locations include the following:

    a. Loading dock.
    b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
    c. Mechanical rooms.
    d. Gymnasiums.

3. Concealed in Ceilings and Interior Walls and Partitions: **EMT**.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Damp or Wet Locations: **GRC**.

6. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 **stainless steel** in institutional and commercial kitchens and damp or wet locations.

C. Minimum Raceway Size: **3/4-inch (21-mm)** trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and applies in thickness and number of coats recommended by manufacturer.
3. EMT: Use **compression**, **steel** fittings. Comply with NEMA FB 2.10.
4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Install surface raceways only where indicated on Drawings.

F. Do not install nonmetallic conduit where ambient temperature exceeds **120 deg F (49 deg C)**.

3.2 INSTALLATION

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

B. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

C. Do not install raceways or electrical items on any "explosion-relief" walls or rotating equipment.

D. Do not fasten conduits onto the bottom side of a metal deck roof.

E. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

F. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

G. Arrange stub-ups so curved portions of bends are not visible above finished slab.

H. Install no more than the equivalent of **three** 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.

I. Make bends in raceway using large-radius preformed ells. Field bending shall be according to NFPA 70 minimum radii requirements. Use only equipment specifically designed for material and size involved.

J. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

K. Support conduit within 12 inches (300 mm) of enclosures to which attached.

L. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot (3-m) intervals.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Arrange raceways to keep a minimum of **2 inches (50 mm)** of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
5. Change from ENT to **GRC** before rising from below grade above floor.

M. Stub-ups to Above Recessed Ceilings:

1. Use EMT for raceways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

N. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

O. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

P. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

Q. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35-mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

R. Install pull wires in all empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

S. Surface Raceways:

1. Install surface raceway with a minimum 2-inch (50-mm) radius control at bend points.
2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

T. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces.

U. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Conduit extending from interior to exterior of building.
4. Conduit extending into pressurized duct and equipment.
5. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
6. Where otherwise required by NFPA 70.

V. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C) and that has straight-run length that exceeds 25 feet (7.6 m).
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

    a. Outdoor Locations Not Exposed to Direct Sunlight: **125 deg F (70 deg C** temperature change.
    b. Outdoor Locations Exposed to Direct Sunlight: **155 deg F (86 deg C** temperature change.
    c. Indoor Spaces Connected with Outdoors without Physical Separation: **125 deg F (70 deg C** temperature change.
    d. Attics/Mechanical Spaces above Hard Lid ceilings: **135 deg F (75 deg C** temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per degree F (0.06 mm per meter of length of straight run per degree C) of temperature change for PVC conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.

5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

W. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of **36 inches (915 mm)** of flexible conduit for **recessed and semirecessed luminaires,** equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC in damp or wet locations not subject to severe physical damage.

X. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to **center** of box unless otherwise indicated.

Y. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between the box and cover plate or the supported equipment and box.

Z. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

AA. Locate boxes so that cover or plate will not span different building finishes.

BB. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

CC. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

DD. Set metal floor boxes level and flush with finished floor surface.

EE. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit.
2. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction.

3. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.

a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete for a minimum of 12 inches (300 mm) on each side of the coupling.
b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

4. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.4 INSTALLATION OF MC CABLES

A. MC CABLES SHALL NOT BE USED FOR HOMERUNS. ALL HOMERUNS SHALL BE IN STEEL CONDUIT (EMT, GRC, ETC).

B. MC cables shall transition to steel conduit (EMT, GRC, ETC) at a junction box or pullbox.

C. Provide separate neutral for all circuits. All multi-wire installations shall comply with NEC 210.4 and district standard to provide separate neutral conductor with each circuit. Shared neutrals shall not be permitted.

D. MC cables shall not be installed visible. MC cables shall not be installed in open ceiling areas.

E. MC cables shall be installed accessible for entire length/run of MC cable. Installations within gyp board construction walls shall be permitted.

F. MC cable shall not be installed underground or within concrete slabs.

G. MC cable shall not be installed exposed on rooftops.

3.5 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.

D. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.8 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 26 05 36 - CABLE TRAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ladder cable tray.
2. Cable tray accessories.
3. Warning signs.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of cable tray.

1. Show fabrication and installation details of cable trays, including plans, elevations, and sections of components and attachments to other construction elements. Designate components and accessories, including clamps, brackets, hanger rods, splice-plate connectors, expansion-joint assemblies, straight lengths, and fittings.
2. Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements. Include the following:

a. Vertical and horizontal offsets and transitions.
b. Clearances for access above and to sides of cable trays.
c. Vertical elevation of cable trays above the floor or bottom of ceiling structure.
d. Load calculations to show dead and live loads as not exceeding manufacturer's rating for tray and its support elements.

C. Delegated-Design Submittal: For seismic restraints.

1. Seismic-Restraint Details: Signed and sealed by a qualified professional engineer who is licensed in the state where Project is located and who is responsible for their preparation.
2. Design Calculations: Calculate requirements for selecting seismic restraints.
3. Detail fabrication, including anchorages and attachments to structure and to supported cable trays.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans and sections, drawn to scale, and coordinated with each other, using input from installers of the items involved:

B. Seismic Qualification Certificates: For cable trays, accessories, and components, from manufacturer.

C. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Cable trays and supports shall withstand the effects of earthquake motions determined according to **ASCE/SEI 7**.

1. The term "withstand" means "cable trays will remain in place without separation of any parts when subjected to the seismic forces specified."

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes in cable tray installed outdoors.

1. Temperature Change: **120 deg F (67 deg C), ambient; 180 deg F (100 deg C).**

2.2 GENERAL REQUIREMENTS FOR CABLE TRAY

A. Cable Trays and Accessories: Identified as defined in NFPA 70 and marked for intended location, application, and grounding.

B. Structural Performance: See articles on individual cable tray types for specific values for the following parameters:

1. Uniform Load Distribution: Capable of supporting a uniformly distributed load on the indicated support span when supported as a simple span and tested according to NEMA VE 1.
2. Concentrated Load: A load applied at midpoint of span and centerline of tray.
3. Load and Safety Factors: Applicable to both side rails and rung capacities.

2.3 LADDER CABLE TRAY

A. Description: Two longitudinal side rails with transverse rungs swaged or welded to side rails, complying with NEMA VE 1.

B. Capacities and Characteristics:

1. Width: **12 inches (300 mm)** unless otherwise indicated on Drawings.
2. Minimum Usable Load Depth: **6 inches (150 mm)**.
3. Straight Section Lengths: **10 feet (3.0 m)** except where shorter lengths are required to facilitate tray assembly.

4. Rung Spacing: **6 inches (150 mm** o.c.
5. Radius-Fitting Rung Spacing: 9 inches (225 mm) at center of tray's width.
6. Minimum Cable-Bearing Surface for Rungs: 7/8-inch (22-mm) width with radius edges.
7. No portion of the rungs shall protrude below the bottom plane of side rails.
8. Structural Performance of Each Rung: Capable of supporting a maximum cable load, with a safety factor of 1.5, plus a 200-lb (90-kg) concentrated load, when tested according to NEMA VE 1.
9. Fitting Minimum Radius: **24 inches (600 mm**
10. Class Designation: Comply with NEMA VE 1, **Class 10AA**
11. Splicing Assemblies: Bolted type using serrated flange locknuts.
12. Splice-Plate Capacity: Splices located within support span shall not diminish rated loading capacity of cable tray.

C. Materials and Finishes:

1. Aluminum:

a. Materials: Alloy 6063-T6 according to ANSI H35.1/H 35.1M for extruded components, and **Alloy 6061-T6** according to ANSI H35.1/H 35.1M for fabricated parts.
b. Hardware: **Stainless steel, Type 316, ASTM F 593 and ASTM F 594**.
c. Hardware for Aluminum Cable Tray Used Outdoors: Stainless steel, Type 316, ASTM F 593 and ASTM F 594.

2.4 CABLE TRAY ACCESSORIES

A. Fittings: Tees, crosses, risers, elbows, and other fittings as indicated, of same materials and finishes as cable tray.

B. Barrier Strips: Same materials and finishes as for cable tray.

C. Cable tray supports and connectors, including bonding jumpers, as recommended by cable tray manufacturer.

2.5 WARNING SIGNS

A. Lettering: **1-1/2-inch- (40-mm** high, black letters on yellow background, with legend "WARNING! NOT TO BE USED AS WALKWAY, LADDER, OR SUPPORT FOR LADDERS OR PERSONNEL."

B. Comply with Section 260553 "Identification for Electrical Systems."

PART 3 - EXECUTION

3.1 CABLE TRAY INSTALLATION

A. Install cable tray and support systems according **NEMA VE 2**.

B. Install cable tray as a complete system, including fasteners, hold-down clips, support systems, barrier strips, adjustable horizontal and vertical splice plates, elbows, reducers, tees, crosses, cable dropouts, adapters, covers, and bonding.

C. Install cable tray, so that the tray is accessible for cable installation and all splices are accessible for inspection and adjustment.

D. Remove burrs and sharp edges from cable trays.

E. Fasten cable tray supports to building structure **and install seismic restraints**.

F. Design fasteners and supports to carry cable tray, cables, and a concentrated load of 200 lb (90 kg). Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems." **Comply with seismic-restraint details according to Section 260548.16 "Seismic Controls for Electrical Systems."**

G. Place supports, so that spans do not exceed maximum spans on schedules, and provide clearances shown on Drawings. Install intermediate supports when cable weight exceeds the load-carrying capacity of tray rungs.

H. Construct supports from channel members, threaded rods, and other appurtenances furnished by cable tray manufacturer. Arrange supports in trapeze or wall-bracket form as required by application.

I. Do not install more than one cable tray splice between supports.

J. Make changes in direction and elevation using manufacturer's recommended fittings.

K. Make cable tray connections using manufacturer's recommended fittings.

L. Seal penetrations through fire and smoke barriers. Comply with requirements in Section 078413 "Penetration Firestopping."

M. Install capped metal sleeves for future cables through firestop-sealed cable tray penetrations of fire and smoke barriers.

N. Install cable trays with enough workspace to permit access for installing cables.

O. Install barriers to separate cables of different systems, such as power, communications, and data processing, or of different insulation levels, such as 600, 5000, and 15 000 V.

P. Install warning signs in visible locations on or near cable trays after cable tray installation.

3.2 CABLE TRAY GROUNDING

A. Ground cable trays according to NFPA 70 unless additional grounding is specified. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Cable trays with electrical power conductors shall be bonded together with splice plates listed for grounding purposes or with listed bonding jumpers.

C. Cable trays with single-conductor power conductors shall be bonded together with a grounding conductor run in the tray along with the power conductors and bonded to the tray at 72-inch (1800-mm) intervals. The grounding conductor shall be sized according to NFPA 70, Article 250.122, "Size of Equipment Grounding Conductors," and Article 392, "Cable Trays."

D. When using epoxy- or powder-coat painted cable trays as a grounding conductor, completely remove coating at all splice contact points or ground connector attachment. After completing splice-to-grounding-bolt attachment, repair the coated surfaces with coating materials recommended by cable tray manufacturer.

E. Bond cable trays to power source for cables contained within with bonding conductors sized according to NFPA 70, Article 250.122, "Size of Equipment Grounding Conductors."

3.3 CONNECTIONS

A. Remove paint from all connection points before making connections. Repair paint after the connections are completed.

B. Connect raceways to cable trays according to requirements in NEMA VE 2 and NEMA FG 1.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections **with the assistance of a factory-authorized service representative**:

1. After installing cable trays and after electrical circuitry has been energized, survey for compliance with requirements.
2. Visually inspect cable insulation for damage. Correct sharp corners, protuberances in cable trays, vibrations, and thermal expansion and contraction conditions, which may cause or have caused damage.
3. Verify that the number, size, and voltage of cables in cable trays do not exceed that permitted by NFPA 70. Verify that communications or data-processing circuits are separated from power circuits by barriers or are installed in separate cable trays.
4. Verify that there are no intruding items, such as pipes, hangers, or other equipment, in the cable tray.
5. Remove dust deposits, industrial process materials, trash of any description, and any blockage of tray ventilation.

6. Visually inspect each cable tray joint and each ground connection for mechanical continuity. Check bolted connections between sections for corrosion. Clean and re-torque in suspect areas.
7. Check for improperly sized or installed bonding jumpers.
8. Check for missing, incorrect, or damaged bolts, bolt heads, or nuts. When found, replace with specified hardware.
9. Perform visual and mechanical checks for adequacy of cable tray grounding; verify that all takeoff raceways are bonded to cable trays. Test entire cable tray system for continuity. Maximum allowable resistance is 1 ohm.

B. Prepare test and inspection reports.

3.5 PROTECTION

A. Protect installed cable trays and cables.

1. Install temporary protection for cables in open trays to safeguard exposed cables against falling objects or debris during construction. Temporary protection for cables and cable tray can be constructed of wood or metal materials and shall remain in place until the risk of damage is over.
2. Repair damage to galvanized finishes with zinc-rich paint recommended by cable tray manufacturer.
3. Repair damage to paint finishes with matching touchup coating recommended by cable tray manufacturer.

END OF SECTION

SECTION 26 05 43 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal conduits and fittings, including GRC and PVC-coated steel conduit.
2. Rigid nonmetallic duct.
3. Duct accessories.
4. Precast concrete handholes.
5. Polymer concrete handholes and boxes with polymer concrete cover.
6. Precast manholes.

1.2 DEFINITIONS

A. Duct: A single duct or multiple ducts. Duct may be either installed singly or as component of a duct bank.

B. Duct Bank:

1. Two or more ducts installed in parallel, with or without additional casing materials.
2. Multiple duct banks.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Precast or Factory-Fabricated Underground Utility Structures:

a. Include plans, elevations, sections, details, attachments to other work, and accessories.
b. Include duct entry provisions, including locations and duct sizes.
c. Include reinforcement details.
d. Include frame and cover design and manhole chimneys.
e. Include ladder details.
f. Include grounding details.
g. Include dimensioned locations of cable rack inserts, pulling-in and lifting irons, and sumps.
h. Include joint details.

2. Factory-Fabricated Handholes and Boxes Other Than Precast Concrete:

   a. Include dimensioned plans, sections, and elevations, and fabrication and installation details.
   b. Include duct entry provisions, including locations and duct sizes.
   c. Include cover design.
   d. Include grounding details.
   e. Include dimensioned locations of cable rack inserts, and pulling-in and lifting irons.

1.4 INFORMATIONAL SUBMITTALS

A. Duct and Duct-Bank Coordination Drawings: Show duct profiles and coordination with other utilities and underground structures. Drawings shall be signed and sealed by a qualified professional engineer.

B. Qualification Data: For professional engineer and testing agency responsible for testing nonconcrete handholes and boxes.

C. Product Certificates: For concrete and steel used in precast concrete manholes and handholes, as required by ASTM C 858.

D. Source quality-control reports.

E. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND FITTINGS

A. GRC: Comply with ANSI C80.1 and UL 6.

B. Coated Steel Conduit: PVC-coated GRC.

   1. Comply with NEMA RN 1.
   2. Coating Thickness: 0.040 inch (1 mm), minimum.

C. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.

2.2 RIGID NONMETALLIC DUCT

A. Underground Plastic Utilities Duct: Type EPC-40-PVC RNC, complying with NEMA TC 2 and UL 651, with matching fittings complying with NEMA TC 3 by same manufacturer as duct.

B. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.

C. Solvents and Adhesives: As recommended by conduit manufacturer.

2.3 DUCT ACCESSORIES

A. Duct Spacers: Factory-fabricated, rigid, PVC interlocking spacers; sized for type and size of duct with which used, and selected to provide minimum duct spacing indicated while supporting duct during concreting or backfilling.

B. Underground-Line Warning Tape: Comply with requirements for underground-line warning tape specified in Section 260553 "Identification for Electrical Systems."

2.4 PRECAST CONCRETE HANDHOLES AND BOXES

A. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom unless open-bottom enclosures are indicated. Frame and cover shall form top of enclosure and shall have load rating consistent with that of handhole or box.

B. Comply with ASTM C 858 for design and manufacturing processes.

C. Frame and Cover: Weatherproof steel frame, with hinged steel access door assembly with tamper-resistant, captive, cover-securing bolts.

1. Cover Hinges: Concealed, with hold-open ratchet assembly.
2. Cover Handle: Recessed.

D. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

E. Cover Legend: Molded lettering, "ELECTRIC" or COMMUNICATIONS”.

F. Configuration: Units shall be designed for flush burial and have integral closed bottom unless otherwise indicated.

G. Extensions and Slabs: Designed to mate with bottom of enclosure. Same material as enclosure.

1. Extension shall provide increased depth of 12 inches (300 mm).
2. Slab: Same dimensions as bottom of enclosure, and arranged to provide closure.

H. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.

I. Knockout Panels: Precast openings in walls, arranged to match dimensions and elevations of approaching duct, plus an additional 12 inches (300 mm) vertically and horizontally to accommodate alignment variations.

J. Duct Entrances in Handhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.

K. Handholes 12 inches wide by 24 inches long (300 mm wide by 600 mm long) and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.5 POLYMER CONCRETE HANDHOLES AND BOXES WITH POLYMER CONCRETE COVER

A. Description: Molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two.

B. Standard: Comply with SCTE 77. Comply with tier requirements in "Underground Enclosure Application" Article.

C. Color: Gray.

D. Configuration: Units shall be designed for flush burial and have integral closed bottom unless otherwise indicated.

E. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.

F. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

G. Cover Legend: Molded lettering, "ELECTRIC “ or “COMMUNICATIONS”

H. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering duct for secure, fixed installation in enclosure wall.

I. Handholes 12 inches wide by 24 inches long (300 mm wide by 600 mm long and larger shall have factory-installed inserts for cable racks and pulling-in irons.

2.6 PRECAST MANHOLES

A. Description: One-piece units and units with interlocking mating sections, complete with accessories, hardware, and features.

B. Comply with ASTM C 858.

C. Structural Design Loading: Comply with requirements in "Underground Enclosure Application" Article.

D. Knockout Panels: Precast openings in walls, arranged to match dimensions and elevations of approaching duct, plus an additional 12 inches (300 mm) vertically and horizontally to accommodate alignment variations.

E. Ground Rod Sleeve: Provide a 3-inch (75-mm) PVC sleeve in manhole floors 2 inches (50 mm) from the wall adjacent to, but not underneath, the duct entering the structure.

F. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.

G. Manhole Sump Frame and Grate: ASTM A 48/A 48M, Class 30B, gray cast iron.

H. Pulling Eyes in Concrete Walls: Eyebolt with reinforcing-bar fastening insert, 2-inch- (50-mm-) diameter eye, and 1-by-4-inch (25-by-100-mm) bolt.

1. Working Load Embedded in 6-Inch (150-mm), 4000-psi (27.6-MPa) Concrete: 13,000-lbf (58-kN) minimum tension.

I. Pulling-in and Lifting Irons in Concrete Floors: 7/8-inch- (22-mm-) diameter, hot-dip galvanized, bent steel rod; stress relieved after forming; and fastened to reinforcing rod. Exposed triangular opening.

1. Ultimate Yield Strength: 40,000-lbf (180-kN) shear and 60,000-lbf (270-kN) tension.

J. Bolting Inserts for Concrete Utility Structure Cable Racks and Other Attachments: Flared, threaded inserts of noncorrosive, chemical-resistant, nonconductive thermoplastic material; 1/2-inch (13-mm) ID by 2-3/4 inches (69 mm) deep, flared to 1-1/4 inches (31 mm) minimum at base.

1. Tested Ultimate Pullout Strength: 12,000 lbf (53 kN) minimum.

K. Cable Rack Assembly: Steel, hot-rolled galvanized, except insulators.

1. Stanchions: T-section or channel with provisions to connect to other sections or channels to form a continuous unit; 1-1/2 inches (38 mm) in width by nominal 24 inches (600 mm) long; punched with 14 hook holes on 1-1/2-inch (38-mm) centers for cable-arm attachment.
2. Arms: 1-1/2 inches (38 mm) wide, lengths ranging from 3 inches (75 mm) with 450-lb (204-kg) minimum capacity to 18 inches (450 mm) with 250-lb (114-kg) minimum capacity. Arms shall have slots along full length for cable ties and be arranged for secure mounting in horizontal position at any vertical location on stanchions.
3. Insulators: High-glaze, wet-process porcelain arranged for mounting on cable arms.

L. Duct-Sealing Compound: Nonhardening, safe for contact with human skin, not deleterious to cable insulation, and workable at temperatures as low as 35 deg F (2 deg C). Capable of

withstanding temperature of 300 deg F (150 deg C) without slump and adhering to clean surfaces of plastic ducts, metallic conduit, conduit and duct coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals.

M. Fixed Manhole Ladders: Arranged for attachment to roof and floor of manhole. Ladder and mounting brackets and braces shall be fabricated from nonconductive, structural-grade, fiberglass-reinforced resin.

N. Cover Hooks: Heavy duty, designed for lifts 60 lb/f (270 N) and greater Two required.

2.7 SOURCE QUALITY CONTROL

A. Test and inspect precast concrete utility structures according to ASTM C 1037.

B. Nonconcrete Handhole and Pull-Box Prototype Test: Test prototypes of manholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by an independent testing agency.
2. Strength tests of complete boxes and covers shall be by an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification, complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate layout and installation of duct, duct bank, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field. Notify Architect if there is a conflict between areas of excavation and existing structures or archaeological sites to remain.

B. Coordinate elevations of duct and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of duct and duct banks, as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions and to ensure that duct and duct bank will drain to manholes and handholes, and as approved by Architect.

3.2 UNDERGROUND DUCT APPLICATION

A. Duct for Electrical Feeders 600 V and Less: Type EPC-40-PVC, concrete-encased unless otherwise indicated.

B. Duct for Electrical Branch Circuits: RNC Type EPC-40-PVC, direct-buried unless otherwise indicated.

C. Underground Ducts Crossing Paved Paths, Walks and Roadways: RNC Type EPC-40 PVC, encased in reinforced concrete.

D. Stub-ups: Concrete-encased GRC.

3.3 UNDERGROUND ENCLOSURE APPLICATION

A. Handholes and Boxes for 600 V and Less:

1. Units in Roadways and Other Deliberate Traffic Paths: Precast concrete. AASHTO HB 17, H-20 structural load rating.
2. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Non deliberate Loading by Heavy Vehicles: Precast concrete, AASHTO HB 17, H-20 structural load rating.
3. Units in Sidewalk and Similar Applications with a Safety Factor for Non deliberate Loading by Vehicles: Precast concrete, AASHTO HB 17, H-10 structural load rating.
4. Units Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin structurally tested according to SCTE 77 with 3000-lbf (13 345-N) vertical loading.
5. Cover design load shall not exceed the design load of the handhole or box.

B. Manholes: Precast concrete.

1. Units Located in Roadways and Other Deliberate Traffic Paths by Heavy or Medium Vehicles: H-20 structural load rating according to AASHTO HB 17.
2. Units Not Located in Deliberate Traffic Paths by Heavy or Medium Vehicles: H-10 load rating according to AASHTO HB 17.

3.4 EARTHWORK

A. Excavation and Backfill: Comply with Section 312200 "Earth Moving," but do not use heavy-duty, hydraulic-operated, compaction equipment.

B. Restoration: Replace area immediately after backfilling is completed or after construction vehicle traffic in immediate area is complete.

3.5 DUCT AND DUCT-BANK INSTALLATION

A. Where indicated on Drawings, install duct, spacers, and accessories into the duct-bank configuration shown. Duct installation requirements in this Section also apply to duct bank.

B. Install duct according to NEMA TCB 2.

C. Slope: Pitch duct a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope duct from a high point between two manholes, to drain in both directions.

D. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches (1200 mm), both horizontally and vertically, at other locations unless otherwise indicated.

1. Duct shall have maximum of two 90 degree bends or the total of all bends shall be no more 180 degrees between pull points.

E. Joints: Use solvent-cemented joints in duct and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent duct do not lie in same plane.

F. End Bell Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches (250 mm) o.c. for 5-inch (125-mm) duct, and vary proportionately for other duct sizes.

G. Terminator Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use manufactured, cast-in-place duct terminators, with entrances into structure spaced approximately 6 inches (150 mm) o.c. for 4-inch (100-mm) duct, and vary proportionately for other duct sizes.

H. Building Wall Penetrations: Make a transition from underground duct to GRC at least 10 feet (3 m) outside the building wall, without reducing duct line slope away from the building and without forming a trap in the line. Use fittings manufactured for RNC-to-GRC transition. Install GRC penetrations of building walls as specified in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

I. Sealing: Provide temporary closure at terminations of duct with pulled cables. Seal spare duct at terminations. Use sealing compound and plugs to withstand at least 15-psig (1.03-MPa) hydrostatic pressure.

J. Pulling Cord: Install 200-lbf- (1000-N-) test nylon cord in empty ducts.
1. Depth: Install so top of duct envelope is at least 24 inches (600 mm) below finished grade in areas not subject to deliberate traffic, and at least 30 inches (750 mm) below finished grade in deliberate traffic paths for vehicles unless otherwise indicated.
2. Support duct on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.
3. Spacer Installation: Place spacers close enough to prevent sagging and deforming of duct, with not less than four spacers per 20 feet (6 m) of duct. Place spacers within 24 inches (600 mm) of duct ends. Stagger spacers approximately 6 inches (150 mm) between tiers. Secure spacers to earth and to duct to prevent floating during concreting. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.

4. Minimum Space between Duct: 3 inches (75 mm) between edge of duct and exterior envelope wall, 2 inches (50 mm) between ducts for like services, and 4 inches (100 mm) between power and communications ducts.
5. Elbows: Use manufactured duct elbows for stub-ups, at building entrances, and at changes of direction in duct unless otherwise indicated. Extend encasement throughout length of elbow.
6. Elbows: Use manufactured GRC elbows for stub-ups, at building entrances, and at changes of direction in duct run.
7. Reinforcement: Reinforce concrete-encased duct where crossing disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
8. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
9. Concrete Cover: Install a minimum of 3 inches (75 mm) of concrete cover between edge of duct to exterior envelope wall, 2 inches (50 mm) between duct of like services, and 4 inches (100 mm) between power and communications ducts.
10. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.
11. Pouring Concrete: Comply with requirements in "Concrete Placement" Article in Section 033000 "Cast-in-Place Concrete." Place concrete carefully during pours to prevent voids under and between duct and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Allow concrete to flow around duct and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-installation application.
    a. Place minimum 6 inches (150 mm) of engineered fill above concrete encasement of duct.

K. Underground-Line Warning Tape: Bury conducting underground line specified in Section 260553 "Identification for Electrical Systems" no less than 12 inches (300 mm) above all concrete-encased duct and duct banks and approximately 12 inches (300 mm) below grade. Align tape parallel to and within 3 inches (75 mm) of centerline of duct bank. Provide an additional warning tape for each 12-inch (300-mm) increment of duct-bank width over a nominal 18 inches (450 mm). Space additional tapes 12 inches (300 mm) apart, horizontally.

3.6 INSTALLATION OF CONCRETE MANHOLES, HANDHOLES, AND BOXES

A. Precast Concrete Handhole and Manhole Installation:

1. Comply with ASTM C 891 unless otherwise indicated.
2. Install units level and plumb and with orientation and depth coordinated with connecting duct, to minimize bends and deflections required for proper entrances.
3. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch (25-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.

B. Elevations:

1. Manhole Roof: Install with rooftop at least 15 inches (375 mm) below finished grade.
2. Manhole Frame: In paved areas and trafficways, set frames flush with finished grade. Set other manhole frames 1 inch (25 mm) above finished grade.
3. Handhole Covers: In paved areas and trafficways, set surface flush with finished grade. Set covers of other handholes 1 inch (25 mm) above finished grade.
4. Where indicated, cast handhole cover frame integrally with handhole structure.

C. Drainage: Install drains in bottom of manholes where indicated. Coordinate with drainage provisions indicated.

D. Manhole Access: Circular opening in manhole roof; sized to match cover size.

1. Manholes with Fixed Ladders: Offset access opening from manhole centerlines to align with ladder.
2. Install chimney, constructed of precast concrete collars and rings, to support cast-iron frame to connect cover with manhole roof opening. Provide moisture-tight masonry joints and waterproof grouting for frame to chimney.

E. Waterproofing: Apply waterproofing to exterior surfaces of manholes and handholes after concrete has cured at least three days. After duct has been connected and grouted, and before backfilling, waterproof joints and connections, and touch up abrasions and scars. Waterproof exterior of manhole chimneys after mortar has cured at least three days.

F. Hardware: Install removable hardware, including pulling eyes, cable stanchions, and cable arms, and insulators, as required for installation and support of cables and conductors and as indicated.

G. Fixed Manhole Ladders: Arrange to provide for safe entry with maximum clearance from cables and other items in manholes.

H. Field-Installed Bolting Anchors in Manholes and Concrete Handholes: Do not drill deeper than 3-7/8 inches (97 mm) for manholes and 2 inches (50 mm) for handholes, for anchor bolts installed in the field. Use a minimum of two anchors for each cable stanchion.

3.7 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting duct, to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of duct, and seal joint between box and extension as recommended by manufacturer.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas and trafficways, set cover flush with finished grade. Set covers of other handholes 1 inch (25 mm) above finished grade.

D. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in enclosure.

E. Field cut openings for duct according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.8 GROUNDING

A. Ground underground ducts and utility structures according to Section 260526 "Grounding and Bonding for Electrical Systems."

3.9 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Demonstrate capability and compliance with requirements on completion of installation of underground duct, duct bank, and utility structures.
2. Pull solid aluminum or wood test mandrel through duct to prove joint integrity and adequate bend radii, and test for out-of-round duct. Provide a minimum 12-inch- (300-mm-) long mandrel equal to duct size minus 1/4 inch (6 mm). If obstructions are indicated, remove obstructions and retest.
3. Test manhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Correct deficiencies and retest as specified above to demonstrate compliance.

C. Prepare test and inspection reports.
1. All inspections shall include photo documentation with narrative and description of work inspected.
2. The district and engineer of record shall review all inspection reports and shall be accepted only with stamp and signed by EEOR.
3. Only after all reports are completed, the contractor shall schedule for inspection by EEOR.

D. Acceptance.
1. Prior to backfill, the contractor shall contract with the EEOR for all site visits and inspections of all underground work prior to EEOR report and recommendations to the district for acceptance.
2. The district shall not accept the underground work without the EEOR report and recommendations.

3.10 CLEANING

A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ALL INSTALLED DUCTS until duct cleaner indicates that duct is clear of dirt and debris. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

B. Clean internal surfaces of manholes, including sump.

1. Sweep floor, removing dirt and debris.
2. Remove foreign material.

END OF SECTION

SECTION 26 05 44

SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. Sleeves for Rectangular Openings:

1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and with no side larger than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).

b. For sleeve cross-section rectangle perimeter 50 inches (1270 mm) or more and one or more sides larger than 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
   1. Sealing Elements: **EPDM** rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
   2. Pressure Plates: **Stainless steel**.
   3. Connecting Bolts and Nuts: **Stainless steel** of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

2.4 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.

   1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide **1/4-inch (6.4-mm)** annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
5. Install sleeves for floor penetrations. Extend sleeves installed in floors **2 inches (50 mm)** above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using **steel** pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION

SECTION 260548.16 - SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Restraint channel bracings.
2. Restraint cables.
3. Seismic-restraint accessories.
4. Mechanical anchor bolts.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.

   a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by a **service member of ICC-ES**
   b. Annotate to indicate application of each product submitted and compliance with requirements.

B. Delegated-Design Submittal: For each seismic-restraint device.

1. Include design calculations and details for selecting seismic restraints complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
2. Design Calculations: Calculate static and dynamic loading caused by equipment weight, operation, and seismic forces required to select seismic restraints and for designing vibration isolation bases.

   a. Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.

3. Seismic-Restraint Details:

   a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
   b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces

transmitted to the structure during seismic events. Indicate association with vibration isolation devices.

c. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.

d. Preapproval and Evaluation Documentation: Evaluation by a **service member of ICC-ES** showing maximum ratings of restraint items and the basis for approval (tests or calculations).

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of seismic bracing for electrical components with other systems and equipment in the vicinity, including other supports and seismic restraints.

B. Qualification Data: For **professional engineer and testing agency**.

C. Welding certificates.

D. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

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

C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis. They shall bear anchorage preapproval by ICC-ES or another agency acceptable to authorities having jurisdiction. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) that support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

D. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

1. Building Classification Category: III**.**
2. Minimum 10 lb/sq. ft. (48.8 kg/sq. m) multiplied by maximum area of component projected on vertical plane normal to wind direction and 45 degrees either side of normal.

B. Seismic-Restraint Loading:

1. Site Class as Defined in the IBC: **D2**
2. Assigned Seismic Use Group or Building Category as Defined in the IBC: **III**.

    a. Component Importance Factor: **1.5**.
    b. Component Response Modification Factor: **2.5**.
    c. Component Amplification Factor:**2.5**.

3. Design Spectral Response Acceleration at Short Periods (0.2 Second).
4. Design Spectral Response Acceleration at 1.0-Second Period.

2.2 RESTRAINT CHANNEL BRACINGS

A. Description: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end, with other matching components, and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.3 RESTRAINT CABLES

A. Restraint Cables: **ASTM A 492 stainless** steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; with a minimum of two clamping bolts for cable engagement.

2.4 SEISMIC-RESTRAINT ACCESSORIES

A. Hanger-Rod Stiffener: **Steel tube or steel slotted-support-system sleeve with internally bolted connections** to hanger rod.

B. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to **rigid channel bracings and restraint cables**.

C. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings and matched to type and size of anchor bolts and studs.

D. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings and matched to type and size of attachment devices used.

E. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.5 MECHANICAL ANCHOR BOLTS

A. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by **an evaluation service member of ICC-ES**.

B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods caused by seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.2 SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points.

B. Equipment and Hanger Restraints:

1. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
2. Install seismic-restraint devices using methods approved by **an evaluation service member of ICC-ES** providing required submittals for component.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

E. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

F. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.

3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.3 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where connection is terminated to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
2. Test at least **four** of each type and size of installed anchors and fasteners selected by Architect.
3. Test to 90 percent of rated proof load of device.

B. Seismic controls will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 260548.16

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS -

PART 1 - GENERAL -

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. - Section Includes:

1. - Color and legend requirements for raceways, conductors, and warning labels and signs.
2. - Labels.
3. - Bands and tubes.
4. - Tapes and stencils.
5. - Tags.
6. - Signs.
7. - Cable ties.
8. - Paint for identification.
9. - Fasteners for labels and signs.

1.3 ACTION SUBMITTALS

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

B. - Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.

C. - Delegated-Design Submittal: For arc-flash hazard study.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. - Comply with NFPA 70.

B. - Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

C. Comply with ANSI Z535.4 for safety signs and labels. -

D. Comply with NFPA 70E and Section 260573.19 "Arc-Flash Hazard Analysis" requirements for arc-flash warning labels.

E. - Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

F. - Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. - Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 COLOR AND LEGEND REQUIREMENTS

A. - Raceways and Cables Carrying Circuits at 600 V or Less:

1. - Black letters on an orange field.
2. - Legend: Indicate voltage .

B. - Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder, and branch-circuit conductors.

1. - Color shall be factory applied[or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.
2. - Colors for 208/120-V Circuits:

a. - Phase A: Black.
b. - Phase B: Red.
c. - Phase C: Blue.

3. - Colors for 480/277-V Circuits:

a. - Phase A: Brown.
b. - Phase B: Orange.
c. - Phase C: Yellow.

4. - Color for Neutral: White or gray.
5. - Color for Equipment Grounds: Bare copper or Green.
6. - Colors for Isolated Grounds: Green with white stripe.

C. - Warning Label Colors:

1. - Identify system voltage with black letters on an orange background.

D. - Warning labels and signs shall include, but are not limited to, the following legends:
1. - Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."
2. - Arc flash
3. - Multiple voltages.

E. - Equipment Identification Labels:

1. - Black letters on a white field.

2.3 LABELS

A. - Self-Adhesive Wraparound Labels: Preprinted, 3-mil- (0.08-mm-) thick, polyester flexible label with acrylic pressure-sensitive adhesive.
   1. - Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized such that the clear shield overlaps the entire printed legend.
   2. - Marker for Labels: Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.
   3. - Minimum Nominal Size:

      a. - 1-1/2 by 6 inches (37 by 150 mm)for raceway and conductors.
      b. - 3-1/2 by 5 inches (76 by 127 mm)for equipment.
      c. - As required by authorities having jurisdiction.

2.4 BANDS AND TUBES

A. - Snap-around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches (50 mm) long, with diameters sized to suit diameter and that stay in place by gripping action.

B. - Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameters of and shrunk to fit firmly around item being identified. Full shrink recovery occurs at a maximum of 200 deg F (93 deg C). Comply with UL 224.

2.5 TAPES AND STENCILS

A. - Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

B. - Tape and Stencil: 4-inch- (100-mm-) wide black stripes on 10-inch (250-mm) centers placed diagonally over orange background and is 12 inches (300 mm) wide. Stop stripes at legends.

C. - Floor Marking Tape: 2-inch- (50-mm-) wide, 5-mil (0.125-mm) pressure-sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.

D. - Underground-Line Warning Tape:
   1. - Tape:

      a. - Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
      b. - Printing on tape shall be permanent and shall not be damaged by burial operations.
      c. - Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.

2. - Color and Printing:

a. - Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
b. - Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE".
c. - Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE"
d. - Insert drawing designation in four "Tag" subparagraphs below. Use these designations on Drawings to identify each product.

3. - Tag: Type ID:

a. - Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core; bright colored, continuous-printed on one side with the inscription of the ductbank compounded for direct-burial service.
b. - Width: 3 inches (75 mm).
c. - Overall Thickness: 5 mils (0.125 mm).
d. - Foil Core Thickness: 0.35 mil (0.00889 mm).
e. - Weight: 28 lb/1000 sq. ft. (13.7 kg/100 sq. m).
f. - Tensile according to ASTM D 882: 70 lbf (311.3 N) and 4600 psi (31.7 MPa).

E. - Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch (25 mm).

2.6 SIGNS

A. - Outdoor equipment - Metal-Backed Butyrate Signs:
1. - Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs, with 0.0396-inch (1-mm) galvanized-steel backing, punched and drilled for fasteners, and with colors, legend, and size required for application.
2. - 1/4-inch (6.4-mm) grommets in corners for mounting.
3. - Nominal Size: 10 by 14 inches (250 by 360 mm).

B. - Indoor Equipment - Laminated Acrylic or Melamine Plastic Signs:
1. - Engraved legend.
2. - Thickness:

a. - For signs up to 20 sq. in. (129 sq. cm), minimum 1/16 inch (1.6 mm) thick.
b. - For signs larger than 20 sq. in. (129 sq. cm), 1/8 inch (3.2 mm) thick.
c. - Engraved legend with white letters on a dark gray background
d. - Self-adhesive.
e. - Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.7 CABLE TIES

A. - Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.

1. - Minimum Width: 3/16 inch (5 mm).
2. - Tensile Strength at 73 Deg F (23 Deg C) according to ASTM D 638: 7000 psi (48.2 MPa).
3. - UL 94 Flame Rating: 94V-0.
4. - Temperature Range: Minus 50 to plus 284 deg F (Minus 46 to plus 140 deg C).
5. - Color: Black.

2.8 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. - Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).

B. - Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. - Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

B. - Install identifying devices before installing acoustical ceilings and similar concealment.

C. - Verify identity of each item before installing identification products.

D. - Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

E. - Apply identification devices to surfaces that require finish after completing finish work.

F. - Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.

G. - Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

H. - System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.

1. Secure tight to surface of conductor, cable, or raceway. -

I. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

J. - Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.

K. - Accessible Fittings for Raceways: Identify the covers of each junction and pull box of the following systems with the wiring system legend and system voltage. System legends shall be as follows:
1. - "POWER."
2. - "COMMUNICATIONS."

L. - Self-Adhesive Wraparound Labels: Secure tight to surface of raceway or cable at a location with high visibility and accessibility.

M. - Self-Adhesive Labels:

1. - On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
2. - Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.

N. - Snap-around Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.

O. - Heat-Shrink, Preprinted Tubes: Secure tight to surface at a location with high visibility and accessibility.

P. - Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.

1. - Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.

Q. - Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.

R. - Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's written instructions.

S. - Underground Line Warning Tape:

1. - During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches (400 mm) overall.
2. - Install underground-line warning tape for direct-buried cables and cables in concrete encased raceways.

T. - Metal-Backed Butyrate Signs:

1. - Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
2. - Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on minimum 1-1/2-inch- (38-mm-) high sign; where two lines of text are required, use signs minimum 2 inches (50 mm) high.

U. - Laminated Acrylic or Melamine Plastic Signs:

1. - Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
2. - Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on minimum 1-1/2-inch- (38-mm-) high sign; where two lines of text are required, use signs minimum 2 inches (50 mm) high.

V. - Cable Ties: General purpose, for attaching tags, except as listed below:

1. - Outdoors: UV-stabilized nylon.
2. - In Spaces Handling Environmental Air: Plenum rated.

3.2 IDENTIFICATION SCHEDULE

A. - Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

B. - Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.

C. - Accessible Raceways, 600 V or Less, for Service, Feeder, and Branch Circuits, More Than 30 A and 120 V to Ground: Identify with self-adhesive raceway labels

1. - Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

D. - Accessible Fittings for Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive labels containing the wiring system legend and system voltage. System legends shall be as follows:
1. - "POWER, panel designation and circuit/s number."
2. - "COMMUNICATIONS, system type and cabling function."

E. - Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use self-adhesive wraparound labels to identify the phase.

1. - Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

F. - Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive wraparound labels with the conductor or cable designation, origin, and destination.

G. - Control-Circuit Conductor Termination Identification: For identification at terminations, provide self-adhesive wraparound labels with the conductor designation.

H. - Auxiliary Electrical Systems Conductor Identification: Self-adhesive vinyl tape that is uniform and consistent with system used by manufacturer for factory-installed connections.

1. - Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.

I. - Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.

J. - Workspace Indication: Apply floor marking tape to finished surfaces. Show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

K. - Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.

L. - Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive equipment labels

1. - Apply to exterior of door, cover, or other access.
2. - For equipment with control sources, apply to door or cover of equipment, including, but not limited to, the following:
   a. - Controls with external control power connections.

M. - Arc Flash Warning Labeling: Self-adhesive labels.

N. - Operating Instruction Signs: Self-adhesive labels laminated acrylic or melamine plastic signs].

O. - Equipment Identification Labels:

1. - Indoor Equipment: Self-adhesive label Metal-backed butyrate signs
2. - Outdoor Equipment: Laminated acrylic or melamine sign legend 4 inches (100 mm) high].

END OF SECTION 260553

SECTION 260573.13 - SHORT-CIRCUIT STUDIES -

PART 1 - GENERAL -

1.1 SUMMARY

A. - Section includes a computer-based, fault-current study to determine the minimum interrupting capacity of circuit protective devices.

1.2 ACTION SUBMITTALS

A. - Product Data:

1. - For computer software program to be used for studies.
2. - Submit the following after the approval of system protective devices submittals. Submittals shall be in digital form.

a. - Short-circuit study input data, including completed computer program input data sheets.
b. - Short-circuit study and equipment evaluation report; signed, dated, and sealed by a qualified professional engineer.

1) - Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.
2) - Revised one-line diagram, reflecting field investigation results and results of short-circuit study.

1.3 INFORMATIONAL SUBMITTALS

A. - Qualification Data:

1. - For Power Systems Analysis Software Developer.
2. - For Power System Analysis Specialist.
3. - For Field Adjusting Agency.

B. Product Certificates: For short-circuit study software, certifying compliance with IEEE 399.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data. -

1.5 QUALITY ASSURANCE

A. - Study shall be performed using commercially developed and distributed software designed specifically for power system analysis.

B. - Software algorithms shall comply with requirements of standards and guides specified in this Section.

C. - Manual calculations are unacceptable.

1. - Power System Analysis Software Qualifications: Computer program shall be designed to perform short-circuit studies or have a function, component, or add-on module designed to perform short-circuit studies.
2. - Computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

D. - Power Systems Analysis Specialist Qualifications: Professional engineer licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

E. - Short-Circuit Study Certification: Short-Circuit Study Report shall be signed and sealed by Power Systems Analysis Specialist.

F. - Field Adjusting Agency Qualifications:

1. - Employer of a NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification responsible for all field adjusting of the Work.
2. - A member company of NETA.
3. - Acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 POWER SYSTEM ANALYSIS SOFTWARE DEVELOPERS

A. - Comply with IEEE 399 and IEEE 551.

1. - Analytical features of power systems analysis software program shall have capability to calculate "mandatory" features as listed in IEEE 399.

B. - Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output.

2.2 SHORT-CIRCUIT STUDY REPORT CONTENTS

A. - Executive summary of study findings.

B. - Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.

C. - One-line diagram of modeled power system, showing the following:

1. - Protective device designations and ampere ratings.
2. - Conductor types, sizes, and lengths.
3. - Transformer kilovolt ampere (kVA) and voltage ratings.
4. - Motor and generator designations and kVA ratings.
5. - Switchgear, switchboard, motor-control center, and panelboard designations and ratings.
6. - Derating factors and environmental conditions.
7. - Any revisions to electrical equipment required by the study.

D. - Comments and recommendations for system improvements or revisions in a written document, separate from one-line diagram.

E. - Protective Device Evaluation:

1. - Evaluate equipment and protective devices and compare to available short-circuit currents. Verify that equipment withstand ratings exceed available short-circuit current at equipment installation locations.
2. - Tabulations of circuit breaker, fuse, and other protective device ratings versus calculated short-circuit duties.
3. - For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
4. - For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in standards to 1/2-cycle symmetrical fault current.

F. - Short-Circuit Study Input Data:

1. - One-line diagram of system being studied.
2. - Power sources available.
3. - Manufacturer, model, and interrupting rating of protective devices.
4. - Conductors.
5. - Transformer data.

G. - Short-Circuit Study Output Reports:

1. - Low-Voltage Fault Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

a. - Voltage.
b. - Calculated fault-current magnitude and angle.
c. - Fault-point X/R ratio.
d. - Equivalent impedance.

2. - Momentary Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

a. - Voltage.
b. - Calculated symmetrical fault-current magnitude and angle.
c. - Fault-point X/R ratio.
d. - Calculated asymmetrical fault currents:

1) Based on fault-point X/R ratio. -
2) Based on calculated symmetrical value multiplied by 1.6. -
3) Based on calculated symmetrical value multiplied by 2.7. -

3. - Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

a. - Voltage.
b. - Calculated symmetrical fault-current magnitude and angle.
c. - Fault-point X/R ratio.
d. - No AC Decrement (NACD) ratio.
e. - Equivalent impedance.
f. - Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
g. - Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

PART 3 - EXECUTION

3.1 POWER SYSTEM DATA

A. - Obtain all data necessary for conduct of the study.

B. - Gather and tabulate the required input data to support the short-circuit study. Comply with requirements in Section 017839 "Project Record Documents" for recording circuit protective device characteristics. Record data on a Record Document copy of one-line diagram. Comply with recommendations in IEEE 551 as to the amount of detail that is required to be acquired in the field. Field data gathering shall be under direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification.

3.2 SHORT-CIRCUIT STUDY

A. - Perform study following the general study procedures contained in IEEE 399.

B. - Calculate short-circuit currents according to IEEE 551.

C. - Base study on device characteristics supplied by device manufacturer.

D. - Extent of electrical power system to be studied is indicated on Issued for bid Drawings.

E. - Begin short-circuit current analysis at the service, extending down to system overcurrent protective devices as follows:

1. To normal system low-voltage load buses where fault current is 10 kA or less.

F. - Study electrical distribution system from normal power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.

G. - Include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and apply to low- and medium-voltage, three-phase ac systems. Also account for the fault-current dc decrement to address asymmetrical requirements of interrupting equipment.

H. - Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault and a single line-to-ground fault at each equipment indicated on one-line diagram.

1. - For grounded systems, provide a bolted line-to-ground fault-current study for areas as defined for the three-phase bolted fault short-circuit study.

I. - Include in the report identification of any protective device applied outside its capacity.

END OF SECTION 260573.13

SECTION 260573.16 - COORDINATION STUDIES -

PART 1 - GENERAL

1.1 SUMMARY

A. - Section includes computer-based, overcurrent protective device coordination studies to determine overcurrent protective devices and to determine overcurrent protective device settings for selective tripping.

1.2 ACTION SUBMITTALS

A. - Product Data:

1. - For computer software program to be used for studies.
2. - Submit the following after the approval of system protective devices submittals. Submittals shall be in digital form.

a. - Coordination-study input data, including completed computer program input data sheets.
b. - Study and equipment evaluation reports.

3. - Overcurrent protective device coordination study report; signed, dated, and sealed by a qualified professional engineer.

a. - Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.

1.3 INFORMATIONAL SUBMITTALS

A. - Qualification Data:

1. - For Power System Analysis Software Developer.
2. - For Power Systems Analysis Specialist.
3. - For Field Adjusting Agency.

B. - Product Certificates: For overcurrent protective device coordination study software, certifying compliance with IEEE 399.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data. -

1.5 QUALITY ASSURANCE

A. Studies shall be performed using commercially developed and distributed software designed specifically for power system analysis.

B. - Software algorithms shall comply with requirements of standards and guides specified in this Section.

C. - Manual calculations are unacceptable.

D. - Power System Analysis Software Qualifications:

1. - Computer program shall be designed to perform coordination studies or have a function, component, or add-on module designed to perform coordination studies.
2. - Computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

E. - Power Systems Analysis Specialist Qualifications: Professional engineer licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

F. - Field Adjusting Agency Qualifications:

1. - Employer of a NETA ETT-Certified Technician Level III responsible for all field adjusting of the Work.
2. - A member company of NETA.
3. - Acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 POWER SYSTEM ANALYSIS SOFTWARE DEVELOPERS

A. - Comply with IEEE 242 and IEEE 399.

B. - Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory" features as listed in IEEE 399.

C. - Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.

2.2 COORDINATION STUDY REPORT CONTENTS

A. Executive summary of study findings. -

B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.

C. - One-line diagram of modeled power system, showing the following:

1. - Protective device designations and ampere ratings.
2. - Conductor types, sizes, and lengths.
3. - Transformer kilovolt ampere (kVA) and voltage ratings.
4. - Motor designations and kVA ratings.
5. - Switchgear, switchboard, motor-control center, and panelboard designations.
6. - Any revisions to electrical equipment required by the study.
7. - Study Input Data: As described in "Power System Data" Article.

a. - Short-Circuit Study Output: As specified in "Short-Circuit Study Output Reports" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260573.13 "Short-Circuit Studies."

D. - Protective Device Coordination Study:

1. - Report recommended settings of protective devices, ready to be applied in the field. Use manufacturer's data sheets for recording the recommended setting of overcurrent protective devices when available.

a. - Phase and Ground Relays:

1) - Device tag.
2) - Relay current transformer ratio and tap, time dial, and instantaneous pickup value.
3) - Recommendations on improved relaying systems, if applicable.

b. - Circuit Breakers:

1) Adjustable pickups and time delays (long time, short time, and ground). -
2) Adjustable time-current characteristic. -
3) Adjustable instantaneous pickup. -
4) Recommendations on improved trip systems, if applicable. -

c. - Fuses: Show current rating, voltage, and class.

E. - Time-Current Coordination Curves: Determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:

1. - Device tag and title, one-line diagram with legend identifying the portion of the system covered.
2. - Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.
3. - Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.
4. - Plot the following listed characteristic curves, as applicable:

a. - Power utility's overcurrent protective device.

b. - Low-voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands.
c. - Low-voltage equipment circuit-breaker trip devices, including manufacturer's tolerance bands.
d. - Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves.
e. - Ground-fault protective devices.
f. - The largest feeder circuit breaker in each motor-control center and panelboard.

5. - Maintain selectivity for tripping currents caused by overloads.
6. - Provide adequate time margins between device characteristics such that selective operation is achieved.
7. - Comments and recommendations for system improvements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. - Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance of the Work. Devices to be coordinated are indicated on Drawings.

1. - Proceed with coordination study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to coordination study may not be used in study.

3.2 POWER SYSTEM DATA

A. - Obtain all data necessary for conduct of the overcurrent protective device study.

1. - Verify completeness of data supplied in one-line diagram on Drawings. Call any discrepancies to Architect's attention.
2. - For equipment included as Work of this Project, use characteristics submitted under provisions of action submittals and information submittals for this Project.

B. - Gather and tabulate all required input data to support the coordination study. List below is a guide. Comply with recommendations in IEEE 551 for the amount of detail required to be acquired in the field. Field data gathering shall be under direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification.

3.3 COORDINATION STUDY

A. - Comply with IEEE 242 for calculating short-circuit currents and determining coordination time intervals.

B. - Comply with IEEE 399 for general study procedures.

C. - Base study on device characteristics supplied by device manufacturer.

D. - Extent of electrical power system to be studied is indicated on issued for bid Drawings.

E. - Begin analysis at the service, extending down to system overcurrent protective devices as follows:

1. - To normal system low-voltage load buses where fault current is 10 kA or less.

F. - Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.

G. - Transformer Primary Overcurrent Protective Devices:

1. - Device shall not operate in response to the following:

a. - Inrush current when first energized.
b. - Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
c. - Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.

2. - Device settings shall protect transformers according to IEEE C57.12.00, for fault currents.

H. - Motor Protection:

1. - Select protection for low-voltage motors according to IEEE 242 and NFPA 70.
2. - Select protection for motors served at voltages more than 600 V according to IEEE 620.

I. - Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and protection recommendations in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.

J. - Generator Protection: Select protection according to manufacturer's written instructions and to IEEE 242.

K. - Include the ac fault-current decay from induction motors and apply to low- and medium-voltage, three-phase ac systems. Also account for fault-current dc decrement, to address asymmetrical requirements of interrupting equipment.

L. - Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault and a single line-to-ground fault at each equipment indicated on one-line diagram.

1. - For grounded systems, provide a bolted line-to-ground fault-current study for areas as defined for the three-phase bolted fault short-circuit study.

M. - Protective Device Evaluation:

1. - Evaluate equipment and protective devices and compare to short-circuit ratings.
2. - Adequacy of switchgear, motor-control centers, and panelboard bus bars to withstand short-circuit stresses.
3. - Include in the report identification of any protective device applied outside its capacity.

3.4 LOAD-FLOW AND VOLTAGE-DROP STUDY

A. - Perform a load-flow and voltage-drop study to determine the steady-state loading profile of the system. Analyze power system performance two times as follows:

1. - Determine load flow and voltage drop based on full-load currents obtained in "Power System Data" Article.
2. - Determine load flow and voltage drop based on 80 percent of the design capacity of load buses.
3. - Prepare load-flow and voltage-drop analysis and report to show power system components that are overloaded, or might become overloaded; show bus voltages that are less than as prescribed by NFPA 70.

3.5 MOTOR-STARTING STUDY

A. - Prepare the motor-starting study report, noting light flicker for limits proposed by IEEE 141, and voltage sags so as not to affect operation of other utilization equipment on system supplying the motor.

3.6 FIELD ADJUSTING

A. - Adjust relay and protective device settings according to recommended settings provided by the coordination study. Field adjustments shall be completed by the engineering service division of equipment manufacturer under the "Startup and Acceptance Testing" contract portion.

B. - Make minor modifications to equipment as required to accomplish compliance with short-circuit and protective device coordination studies.

C. - Testing and adjusting shall be by a full-time employee of the Field Adjusting Agency, who holds NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification.

1. - Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters. Perform NETA tests and inspections for all adjustable overcurrent protective devices.

3.7 DEMONSTRATION

A. - Engage Power Systems Analysis Specialist to train Owner's maintenance personnel in the following:

1. - Acquaint personnel in fundamentals of operating the power system in normal and emergency modes.

2. - Hand-out and explain the coordination study objectives, study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpreting time-current coordination curves.
3. - For Owner's maintenance staff certified as NETA ETT-Certified Technicians Level III or NICET Electrical Power Testing Level III Technicians, teach how to adjust, operate, and maintain overcurrent protective device settings.

END OF SECTION 260573.16

SECTION 260573.19 - ARC-FLASH HAZARD ANALYSIS -

PART 1 - GENERAL -

1.1 SUMMARY

A. - Section includes a computer-based, arc-flash study to determine the arc-flash hazard distance and the incident energy to which personnel could be exposed during work on or near electrical equipment.

1.2 ACTION SUBMITTALS

A. - Product Data: For computer software program to be used for studies.

B. - Study Submittals: Submit the following submittals after the approval of system protective devices submittals. Submittals shall be in digital form:

1. - Arc-flash study input data, including completed computer program input data sheets.
2. - Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.

1.3 INFORMATIONAL SUBMITTALS

A. - Qualification Data:

1. - For Power Systems Analysis Software Developer.
2. - For Power System Analysis Specialist.
3. - For Field Adjusting Agency.

B. - Product Certificates: For arc-flash hazard analysis software, certifying compliance with IEEE 1584 and NFPA 70E.

1.4 CLOSEOUT SUBMITTALS

A. - Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Study shall be performed using commercially developed and distributed software designed specifically for power system analysis.

B. Software algorithms shall comply with requirements of standards and guides specified in this Section.

C. - Manual calculations are unacceptable.

D. - Power System Analysis Software Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

1. - Computer program shall be designed to perform arc-flash analysis or have a function, component, or add-on module designed to perform arc-flash analysis.
2. - Computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

E. - Power Systems Analysis Specialist Qualifications: Professional engineer in charge of performing the arc-flash study, analyzing the arc flash, and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

F. - Arc-Flash Study Certification: Arc-Flash Study Report shall be signed and sealed by Power Systems Analysis Specialist.

G. - Field Adjusting Agency Qualifications:

1. - Employer of a NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification responsible for all field adjusting of the Work.
2. - A member company of NETA.
3. - Acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE DEVELOPERS

A. - Comply with IEEE 1584 and NFPA 70E.

B. - Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory" features as listed in IEEE 399.

2.2 ARC-FLASH STUDY REPORT CONTENT

A. - Executive summary of study findings.

B. - Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.

C. - One-line diagram, showing the following:

1. - Protective device designations and ampere ratings.
2. - Conductor types, sizes, and lengths.
3. - Transformer kilovolt ampere (kVA) and voltage ratings, including derating factors and environmental conditions.

4. - Motor and generator designations and kVA ratings.
5. - Switchgear, switchboard, motor-control center, panelboard designations, and ratings.

D. - Study Input Data: As described in "Power System Data" Article.

E. - Short-Circuit Study Output Data: As specified in "Short-Circuit Study Output Reports" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260573.13 "Short-Circuit Studies."

F. - Protective Device Coordination Study Report Contents: As specified in "Coordination Study Report Contents" Article in Section 260573.16 "Coordination Studies."

G. - Arc-Flash Study Output Reports:

1. - Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each equipment location included in the report:

a. - Voltage.
b. - Calculated symmetrical fault-current magnitude and angle.
c. - Fault-point X/R ratio.
d. - No AC Decrement (NACD) ratio.
e. - Equivalent impedance.
f. - Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
g. - Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

H. - Incident Energy and Flash Protection Boundary Calculations:

1. - Arcing fault magnitude.
2. - Protective device clearing time.
3. - Duration of arc.
4. - Arc-flash boundary.
5. - Restricted approach boundary.
6. - Limited approach boundary.
7. - Working distance.
8. - Incident energy.
9. - Hazard risk category.
10. - Recommendations for arc-flash energy reduction.

I. - Fault study input data, case descriptions, and fault-current calculations including a definition of terms and guide for interpretation of computer printout.

2.3 ARC-FLASH WARNING LABELS

A. - Comply with requirements in Section 260553 "Identification for Electrical Systems" for self-adhesive equipment labels. Produce a 3.5-by-5-inch (76-by-127-mm) self-adhesive equipment label for each work location included in the analysis.

B. - Label shall have an orange header with the wording, "WARNING, ARC-FLASH HAZARD," and shall include the following information taken directly from the arc-flash hazard analysis:

1. - Location designation.
2. - Nominal voltage.
3. - Protection boundaries.

    a. - Arc-flash boundary.
    b. - Restricted approach boundary.
    c. - Limited approach boundary.

4. - Arc flash PPE category.
5. - Required minimum arc rating of PPE in Cal/cm squared.
6. - Available incident energy.
7. - Working distance.
8. - Engineering report number, revision number, and issue date.

C. - Labels shall be machine printed, with no field-applied markings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. - Examine Project overcurrent protective device submittals. Proceed with arc-flash study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to arc-flash study may not be used in study.

3.2 ARC-FLASH HAZARD ANALYSIS

A. - Comply with NFPA 70E and its Annex D for hazard analysis study.

B. - Preparatory Studies: Perform the Short-Circuit and Protective Device Coordination studies prior to starting the Arc-Flash Hazard Analysis.

1. - Short-Circuit Study Output: As specified in "Short-Circuit Study Output Reports" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260573.13 "Short-Circuit Studies."
2. - Coordination Study Report Contents: As specified in "Coordination Study Report Contents" Article in Section 260573.16 "Coordination Studies."

C. - Calculate maximum and minimum contributions of fault-current size.

1. - Maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.
2. - Calculate arc-flash energy at 85 percent of maximum short-circuit current according to IEEE 1584 recommendations.

D. - Calculate the arc-flash protection boundary and incident energy at locations in electrical distribution system where personnel could perform work on energized parts.

E. - Include low-voltage equipment locations, except equipment rated 240 V ac or less fed from transformers less than 125 kVA.

F. - Calculate the limited, restricted, and prohibited approach boundaries for each location.

G. - Incident energy calculations shall consider the accumulation of energy over time when performing arc-flash calculations on buses with multiple sources. Iterative calculations shall take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators shall be decremented as follows:

1. - Fault contribution from induction motors shall not be considered beyond three to five cycles.

H. - Arc-flash energy shall generally be reported for the maximum of line or load side of a circuit breaker. However, arc-flash computation shall be performed and reported for both line and load side of a circuit breaker as follows:

1. - When the circuit breaker is in a separate enclosure.
2. - When the line terminals of the circuit breaker are separate from the work location.

I. - Base arc-flash calculations on actual overcurrent protective device clearing time. Cap maximum clearing time at two seconds based on IEEE 1584, Section B.1.2.

3.3 POWER SYSTEM DATA

A. - Obtain all data necessary for conduct of the arc-flash hazard analysis.

1. - Verify completeness of data supplied on one-line diagram on Drawings and under "Preparatory Studies" Paragraph in "Arc-Flash Hazard Analysis" Article. Call discrepancies to Architect's attention.
2. - For new equipment, use characteristics from approved submittals under provisions of action submittals and information submittals for this Project.

3.4 LABELING

A. - Apply one arc-flash label on the front cover of each section of the equipment and on side or rear covers with accessible live parts and hinged doors or removable plates for each equipment included in the study. Base arc-flash label data on highest values calculated at each location.

B. - Each piece of equipment listed below shall have an arc-flash label applied to it:

1. - Motor-control center.
2. - Low-voltage switchboard.
3. - Switchgear.
4. - Low voltage transformers. Panelboard and safety switch over 250 V.
5. - Applicable panelboard Control panel.

C. - Note on record Drawings the location of equipment where the personnel could be exposed to arc-flash hazard during their work.

1. - Indicate arc-flash energy.
2. - Indicate protection level required.

3.5 APPLICATION OF WARNING LABELS

A. - Install arc-flash warning labels under the direct supervision and control of Power System Analysis Specialist.

3.6 DEMONSTRATION

A. - Engage Power Systems Analysis Specialist to train Owner's maintenance personnel in potential arc-flash hazards associated with working on energized equipment and the significance of arc-flash warning labels.

END OF SECTION 260573.19

SECTION 260923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Time switches.
2. Photoelectric switches.
3. Standalone daylight-harvesting switching and dimming controls.
4. Indoor occupancy and vacancy sensors.
5. Switchbox-mounted occupancy and vacancy sensors
6. Outdoor motion sensors
7. Lighting contactors
8. Digital timer light switches.

B. Related Requirements:

1. Section 262726 "Wiring Devices" for wall-box dimmers, non-networkable wall-switch occupancy sensors, and manual light switches.

2. Products shall be submitted per Escondido Unified High School District Design Standards.
   a. Wattstopper by Legrand
   b. Nlight, and “Blue Box” by Acuity

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Show installation details for the following:

   a. Occupancy sensors.
   b. Vacancy sensors.

2. Interconnection diagrams showing field-installed wiring.
3. Include diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and elevations, drawn to scale and coordinated with each other, using input from installers of the items involved.

B. Field quality-control reports.

C. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

B. Software and firmware operational documentation.

1.5 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace lighting control devices that fail(s) in materials or workmanship within specified warranty period.

1. Warranty Period: Two year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 TIME SWITCHES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   a. Wattstopper by Legrand
   b. Nlight by Acuity

B. Electronic Time Switches: Solid state, programmable, with alphanumeric display; complying with UL 917.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Contact Configuration: SPST.
3. Contact Rating: 20-A ballast load, 120-/240-V ac.
4. Programs: Eight on-off set points on a 24-hour schedule and an annual holiday schedule that overrides the weekly operation on holidays.
5. Programs: Two on-off set points on a 24-hour schedule, allowing different set points for each day of the week and an annual holiday schedule that overrides the weekly operation on holidays.
6. Programs: 8 channels; each channel is individually programmable with eight on-off set points on a 24-hour schedule.

7. Programs: 8 channels; each channel is individually programmable with two on-off set points on a 24-hour schedule with a skip-a-day weekly schedule.
8. Programs: 8 channels; each channel is individually programmable with two on-off set points on a 24-hour schedule, allowing different set points for each day of the week.
9. Programs: 8 channels; each channel is individually programmable with 40 on-off operations per week and an annual holiday schedule that overrides the weekly operation on holidays.
10. Programs: 8 channels; each channel is individually programmable with 40 on-off operations per week, plus four seasonal schedules that modify the basic program and an annual holiday schedule that overrides the weekly operation on holidays.
11. Programs: an annual holiday schedule that overrides the weekly operation on holidays].
12. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program on selected channels.
13. Astronomic Time: All channels.
14. Automatic daylight savings time changeover.
15. Battery Backup: Not less than seven days reserve, to maintain schedules and time clock.

C. Electromechanical-Dial Time Switches: Comply with UL 917.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Contact Configuration: SPST.
3. Contact Rating: 20-A ballast load, 120-/240-V ac.
4. Circuitry: Allows connection of a photoelectric relay as a substitute for the on-off function of a program.
5. Astronomic time dial.
6. Eight-Day Program: Uniquely programmable for each weekday and holidays.
7. Skip-a-day mode.

2.2 INDOOR OCCUPANCY AND VACANCY SENSORS

A. General Requirements for Sensors:

1. Wall, Ceiling-mounted, solid-state indoor occupancy sensors.
2. Passive infrared technology.
3. Integrated power pack.
4. Hardwired connection to switch and BAS and lighting control system.
5. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
6. Operation:

    a. Occupancy Sensor: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.

b. Vacancy Sensor: Unless otherwise indicated, lights are manually turned on and sensor turns lights off when the room is unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
c. Combination Sensor: Unless otherwise indicated, sensor shall be programmed to turn lights on when coverage area is occupied and turn them off when unoccupied, or to turn off lights that have been manually turned on; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.

7. Sensor Output: Sensor is powered from the power pack.
8. Power: Line voltage.
9. Power Pack: Dry contacts rated for 20-A LED load at 120--V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
10. Mounting:

a. Sensor: Suitable for mounting in any position on a standard outlet box.
b. Relay: Externally mounted through a 1/2-inch (13-mm) knockout in a standard electrical enclosure.
c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

11. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
12. Bypass Switch: Override the "on" function in case of sensor failure.
13. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (21.5 to 2152 lux); turn lights off when selected lighting level is present.

B. PIR Type: Wall, Ceiling mounted; detect occupants in coverage area by their heat and movement.

1. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm).
2. Detection Coverage (Room, Ceiling Mounted): Detect occupancy anywhere in a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
3. Detection Coverage (Corridor, Ceiling Mounted): Detect occupancy within 90 feet (27.4 m) when mounted on a 10-foot- (3-m-) high ceiling.
4. Detection Coverage (Room, Wall Mounted): Detect occupancy anywhere within a 180-degree pattern centered on the sensor over an area of 1000 square feet (110 square meters) when mounted 48 inches (1200 mm) above finished floor.

C. Ultrasonic Type: Wall, Ceiling mounted; detect occupants in coverage area through pattern changes of reflected ultrasonic energy.

1. Detector Sensitivity: Detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
2. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 sq. ft. (56 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.

3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
4. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. (186 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
5. Detection Coverage (Corridor): Detect occupancy anywhere within 90 feet (27.4 m) when mounted on a 10-foot- (3-m-) high ceiling in a corridor not wider than 14 feet (4.3 m).
6. Detection Coverage (Room, Wall Mounted): Detect occupancy anywhere within a 180-degree pattern centered on the sensor over an area of 1000 square feet (110 square meters) when mounted84 inches (2100 mm) above finished floor.

D. Dual-Technology Type: Wall, Ceiling mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.

1. Sensitivity Adjustment: Separate for each sensing technology.
2. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm), and detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
4. Detection Coverage (Room, Wall Mounted): Detect occupancy anywhere within a 180-degree pattern centered on the sensor over an area of 1000 square feet (110 square meters) when mounted 48 inches (1200 mm) above finished floor.

2.3 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

A. General Requirements for Sensors: Automatic-wall-switch occupancy sensor with manual on-off switch, suitable for mounting in a single gang switchbox, with provisions for connection to BAS using hardwired connection.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application, and shall comply with California Title 24.
2. Occupancy Sensor Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn lights off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
3. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F (0 to 49 deg C).
4. Switch Rating: Not less than 800-VA LED load at 120 V.

2.4 LIGHTING CONTACTORS

A. Description: Electrically operated and mechanically held, combination-type lighting contactors with fusible switch, complying with NEMA ICS 2 and UL 508.

1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less THD of normal load current).
2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
3. Enclosure: Comply with NEMA 250.
4. Provide with control and pilot devices as, matching the NEMA type specified for the enclosure.

2.5 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Examine lighting control devices before installation. Reject lighting control devices that are wet, moisture damaged, or mold damaged.

C. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.

D. Install and aim sensors in locations to achieve not less than 90-percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

E. Mount electrically held lighting contactors with elastomeric isolator pads to eliminate structure-borne vibration unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.2 WIRING INSTALLATION

A. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch (13 mm).

B. Wiring within Enclosures: Separate power-limited and non-power-limited conductors according to conductor manufacturer's written instructions.

C. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.3 IDENTIFICATION

A. Identify components and power and control wiring according to Section 260553 "Identification for Electrical Systems."

B. Label time switches and contactors with a unique designation.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Lighting control devices will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.5 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting lighting control devices to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.
2. For daylighting controls, adjust set points and deadband controls to suit Owner's operations.

3. Align high-bay occupancy sensors using manufacturer's laser aiming tool.

3.6 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.

B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.

1. Upgrade Notice: At least 30 days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION 26 09 23

SECTION 262213 - LOW-VOLTAGE DISTRIBUTION TRANSFORMERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes distribution, dry-type transformers with a nominal primary and secondary rating of 600 V and less, with capacities up to 1500 kVA.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment.
3. Include diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Data: Certificates, for transformers, accessories, and components, from manufacturer.

B. Source quality-control reports.

C. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Accredited by NETA.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Eaton – Dry type, Class 155 insulation or higher.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Transformers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the transformer will remain in place without separation of any parts when subjected to the seismic forces specified and the transformer will be fully operational after the seismic event."

2.3 GENERAL TRANSFORMER REQUIREMENTS

A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.

B. Comply with CEC

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC , by a qualified testing agency, and marked for intended location and use.

C. Transformers Rated 15 kVA and Larger:

1. Comply with 10 CFR 431 (DOE 2016) efficiency levels.
2. Marked as compliant with DOE 2016 efficiency levels by an NRTL.

D. Cores: Electrical grade, non-aging silicon steel with high permeability and low hysteresis losses.

E. Coils: Continuous windings except for taps.

1. Coil Material: Aluminum.
2. Internal Coil Connections: Brazed or pressure type.
3. Terminal Connections: Welded.

F. Shipping Restraints: Paint or otherwise color-code bolts, wedges, blocks, and other restraints that are to be removed after installation and before energizing. Use fluorescent colors that are easily identifiable inside the transformer enclosure.

2.4 DISTRIBUTION TRANSFORMERS

A. Comply with CEC and list and label as complying with UL 1561.

B. Cores: One leg per phase.

C. Enclosure: Ventilated.

1. Outdoor
   a. NEMA 250, Type 3R: Core and coil shall be encapsulated within resin compound to seal out moisture and air.
2. KVA Ratings: Based on convection cooling only and not relying on auxiliary fans.
3. Wiring Compartment: Sized for conduit entry and wiring installation.

D. Taps for Transformers 3 kVA and Smaller: None.

E. Taps for Transformers 7.5 to 24 kVA: One 5 percent tap above and one 5 percent tap below normal full capacity.

F. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity.

G. Insulation Class, Smaller Than 30 kVA: 180 deg C, UL-component-recognized insulation system with a maximum of 115 deg C rise above 40 deg C ambient temperature.

H. Insulation Class, 30 kVA and Larger: 220 deg C, UL-component-recognized insulation system with a maximum of 115 deg C rise above 40 deg C ambient temperature.

I. Grounding: Provide ground-bar kit or a ground bar installed on the inside of the transformer enclosure.

J. Wall Brackets: Wall brackets fabricated from design drawings signed and sealed by a licensed structural engineer.

2.5 IDENTIFICATION

A. Nameplates: Engraved, laminated-acrylic or melamine plastic signs for each distribution transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 260553 "Identification for Electrical Systems."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

B. Verify that field measurements are as needed to maintain working clearances required by CEC and manufacturer's written instructions.

C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.

D. Verify that ground connections are in place and requirements in Section 260526 "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.

E. Environment: Enclosures shall be rated for the environment in which they are located. Covers for NEMA 250, Type 4X enclosures shall not cause accessibility problems.

3.2 INSTALLATION

A. Install wall-mounted transformers level and plumb with wall brackets fabricated from design drawings signed and sealed by a licensed structural engineer.

1. Coordinate installation of wall-mounted and structure-hanging supports with actual transformer provided.

B. Install transformers level and plumb on a concrete base with vibration-dampening supports. Locate transformers away from corners and not parallel to adjacent wall surface.

C. Construct concrete bases and anchor floor-mounted transformers according to manufacturer's written instructions and requirements in Section 260529 "Hangers and Supports for Electrical Systems."

1. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

D. Secure transformer to concrete base according to manufacturer's written instructions.

E. Secure covers to enclosure and tighten all bolts to manufacturer-recommended torques to reduce noise generation.

F. Remove shipping bolts, blocking, and wedges.

3.3 CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

D. Provide flexible connections at all conduit and conductor terminations and supports to eliminate sound and vibration transmission to the building structure.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections with the assistance of a factory-authorized service representative.

B. Small (Up to 167-kVA Single-Phase or 500-kVA Three-Phase) Dry-Type Transformer Field Tests:

1. Visual and Mechanical Inspection.

   a. Inspect physical and mechanical condition.
   b. Inspect anchorage, alignment, and grounding.
   c. Verify that resilient mounts are free and that any shipping brackets have been removed.
   d. Verify the unit is clean.
   e. Perform specific inspections and mechanical tests recommended by manufacturer.
   f. Verify that as-left tap connections are as specified.
   g. Verify the presence of surge arresters and that their ratings are as specified.

2. Electrical Tests:

   a. Measure resistance at each winding, tap, and bolted connection.
   b. Verify correct secondary voltage, phase-to-phase and phase-to-neutral, after energization and prior to loading.

C. Remove and replace units that do not pass tests or inspections and retest as specified above.

3.5 CLEANING

A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION 262213

SECTION 262726 - WIRING DEVICES -

PART 1 - GENERAL -

1.1 SUMMARY

A. - Section Includes:

1. - Specification-grade receptacles, 125 V, 20 A.
2. - USB receptacles.
3. - GFCI receptacles, 125 V, 20 A.
4. - Toggle switches, 120/277 V, 20 A.
5. - Occupancy sensors.
6. - Wall-box dimmers.
7. - Wall plates.

1.2 ACTION SUBMITTALS

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

B. - Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. - Samples: One for each type of device and wall plate specified, in each color specified.

1.3 INFORMATIONAL SUBMITTALS

A. - Field quality-control reports.

PART 2 - PRODUCTS

2.1 GENERAL WIRING-DEVICE REQUIREMENTS

A. - Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. - Comply with NFPA 70.

C. - RoHS compliant.

D. Comply with NEMA WD 1. -

E. Device Color: -

1. - Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.

F. - Wall Plate Color: For plastic covers, match device color.

G. - Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 SPECIFICATION-GRADE RECEPTACLES, 125 V, 20 A

A. - Duplex Receptacles, 125 V, 20 A
1. - Description: Two pole, three wire, and self-grounding.
2. - Configuration: NEMA WD 6, Configuration 5-20R.
3. - Standards: Comply with UL 498 and FS W-C-596.

B. - Tamper-Resistant Duplex Receptacles, 125 V, 20 A
1. - Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle.
2. - Configuration: NEMA WD 6, Configuration 5-20R.
3. - Standards: Comply with UL 498 and FS W-C-596.
4. - Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.

C. - Weather-Resistant Duplex Receptacle, 125 V, 20 A:
1. - Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
2. - Configuration: NEMA WD 6, Configuration 5-20R.
3. - Standards: Comply with UL 498.
4. - Marking: Listed and labeled as complying with NFPA 70, "Receptacles in Damp or Wet Locations" Article.

D. - Tamper- and Weather-Resistant Duplex Receptacles, 125 V, 20 A
1. - Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
2. - Configuration: NEMA WD 6, Configuration 5-20R.
3. - Standards: Comply with UL 498.
4. - Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" and "Receptacles in Damp or Wet Locations" articles.

2.3 USB RECEPTACLES

A. - Tamper-Resistant Duplex and USB Charging Receptacles:
1. - Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap. Integral shutters that operate only when a plug is inserted in the line voltage receptacle.
2. - Line Voltage Receptacles: Two pole, three wire, and self-grounding; NEMA WD 6, Configuration 5-20R.
3. - USB Receptacles: Dual USB Type A, 5 V dc, and 5.0 A per receptacle (minimum).
4. - Standards: Comply with UL 498, UL 1310, USB 3.0 devices, and FS W-C-596.

5. - Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.

2.4 GFCI RECEPTACLES, 125 V, 20 A

A. - Duplex GFCI Receptacles, 125 V, 20 A
1. - Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding.
2. - Configuration: NEMA WD 6, Configuration 5-20R.
3. - Type: Non-Feed through.
4. - Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.

B. - Tamper-Resistant Duplex GFCI Receptacles, 125 V, 20 A:
1. - Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle.
2. - Configuration: NEMA WD 6, Configuration 5-20R.
3. - Type: Non-feed through.
4. - Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.
5. - Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.

C. - Tamper- and Weather-Resistant, GFCI Duplex Receptacles, 125 V, 20 A
1. - Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
2. - Configuration: NEMA WD 6, Configuration 5-15R.
3. - Type Non-feed through.
4. - Standards: Comply with UL 498 and UL 943 Class A.
5. - Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" and "Receptacles in Damp or Wet Locations" articles.

2.5 TOGGLE SWITCHES, 120/277 V, 20 A

A. - Single-Pole Switches, 120/277 V, 20
1. - Standards: Comply with UL 20 and FS W-S-896.

B. - Two-Pole Switches, 120/277 V, 20 A
1. - Comply with UL 20 and FS W-S-896.

C. - Three-Way Switches, 120/277 V, 20 A
1. - Comply with UL 20 and FS W-S-896.

D. - Four-Way Switches, 120/277 V, 20 A
1. - Standards: Comply with UL 20 and FS W-S-896.

E. - Lighted Single-Pole Switches, 120/277 V, 20 A
1. - Description: Handle illuminated when switch is [on] [off].
2. - Standards: Comply with NEMA WD 1, UL 20, and FS W-S-896.

2.6 OCCUPANCY SENSORS

A. - Wall Switch Sensor Light Switch, Dual Technology
1. - Description: Switchbox-mounted, combination lighting-control sensor and conventional switch lighting-control unit using dual (ultrasonic and passive infrared) technology.
2. - Standards: Comply with UL 20.
3. - Rated 960 W at 120 V ac for tungsten lighting, 10 A at 120 V ac or 10 A at 277 V ac for fluorescent or LED lighting, and 1/4 hp at 120 V ac.
4. - Adjustable time delay of 20 minutes.
5. - Able to be locked to Automatic or Manual-On mode.
6. - Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (21.5 to 2152 lux).
7. - Connections: RJ-45 communications outlet.

B. - Wall Sensor Light Switch, Passive Infrared
1. - Description: Switchbox-mounted, combination, lighting-control sensor and conventional switch lighting-control unit using passive infrared technology.
2. - Standards: Comply with UL 20.
3. - Connections: Hard wired.
4. - Rated 960 W at 120 V ac for tungsten lighting, 10 A at 120 V ac or 10 A at 277 V ac for fluorescent or LED lighting, and 1/4 hp at 120 V ac.
5. - Adjustable time delay of 20 minutes.
6. - Able to be locked to Automatic or Manual-On mode.
7. - Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (21.5 to 2152 lux).

C. - Wall Sensor Light Switch, Ultrasonic
1. - Description: Switchbox-mounted, combination, lighting-control sensor and conventional switch lighting-control unit using ultrasonic technology.
2. - Standards: Comply with UL 20.
3. - Connections: RJ-45 communications outlet.
4. - Rated 960 W at 120 V ac for tungsten lighting, 10 A at 120 V ac or 10 A at 277 V ac for fluorescent or LED lighting, and 1/4 hp at 120 V ac.
5. - Adjustable time delay of 20 minutes.
6. - Able to be locked to Automatic or Manual-On mode.
7. - Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (21.5 to 2152 lux).

2.7 TIMER LIGHT SWITCH

A. - Digital Timer Light
1. - Description: Switchbox-mounted, combination digital timer and conventional switch lighting-control unit, with backlit digital display, with selectable time interval in 10 minute increments.
2. - Standards: Comply with UL 20.
3. - Rated 960 W at 120 V ac for tungsten lighting, 10 A at 120 V ac or 10 A at 277 V ac for fluorescent or LED lighting, and 1/4 hp at 120 V ac.

2.8 DIMMERS

A. - Wall-Box Dimmers:

1. - Description: Modular, full-wave, solid-state dimmer switch with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.
2. - Control: Continuously adjustable slider] [toggle switch] [rotary knob]; with single-pole or three-way switching.
3. - Standards: Comply with UL 1472.
4. - LED Lamp Dimmer Switches: Modular; compatible with LED lamps; trim potentiometer to adjust low-end dimming; capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.9 WALL PLATES

A. - Single Source: Obtain wall plates from same manufacturer of wiring devices.

B. - Single and combination types shall match corresponding wiring devices.

1. - Plate-Securing Screws: Metal with head color to match plate finish.
2. - Material for Unfinished Spaces: Galvanized steel
3. - Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

C. - Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

PART 3 - EXECUTION

3.1 INSTALLATION

A. - Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. - Coordination with Other Trades:

1. - Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
2. - Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
3. - Install wiring devices after all wall preparation, including painting, is complete.

C. - Device Installation:

1. - Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
2. - When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

D. - Receptacle Orientation:

1. - Install ground pin of vertically mounted receptacles up and on horizontally mounted receptacles to the left.

E. - Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

F. - Dimmers:

1. - Install dimmers within terms of their listing.
2. - Verify that dimmers used for fan-speed control are listed for that application.
3. - Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device, listing conditions in the written instructions.

G. - Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

H. - Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 FIELD QUALITY CONTROL

A. - Perform the following tests and inspections with the assistance of a factory-authorized service representative:
1. - Test Instruments: Use instruments that comply with UL 1436.
2. - Test Instrument for Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. - Tests for Receptacles:

1. - Line Voltage: Acceptable range is 105 to 132 V.
2. - Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
3. - Ground Impedance: Values of up to 2 ohms are acceptable.
4. - GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. - Using the test plug, verify that the device and its outlet box are securely mounted.

C. - Test straight-blade for the retention force of the grounding blade retention force shall be not less than 4 oz. (115 g).

D. - Wiring device will be considered defective if it does not pass tests and inspections.

E. - Prepare test and inspection reports.

END OF SECTION 262726 -

SECTION 26 51 00

INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Interior lighting fixtures, lamps, and ballasts.
2. Emergency lighting units.
3. Exit signs.
4. Lighting fixture supports.

B. Related Sections:
1. Section 262726 "Wiring Devices" for manual wall-box dimmers for incandescent lamps.

1.3 DEFINITIONS

A. BF: Ballast factor.

B. CCT: Correlated color temperature.

C. CRI: Color-rendering index.

D. HID: High-intensity discharge.

E. LER: Luminaire efficacy rating.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting fixture, including ballast housing if provided.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

1. Physical description of lighting fixture including dimensions.
2. Emergency lighting units including battery and charger.
3. Ballast, including BF.
4. Energy-efficiency data.
5. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.

B. Shop Drawings: For nonstandard or custom lighting fixtures. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

C. Installation instructions.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Lighting fixtures.
2. Suspended ceiling components.
3. Partitions and millwork that penetrate the ceiling or extends to within 12 inches (305 mm) of the plane of the luminaires.
4. Structural members to which suspension systems for lighting fixtures will be attached.
5. Other items in finished ceiling including the following:
    a. Sprinklers.
    b. Smoke and fire detectors.
    c. Occupancy sensors.
    d. Access panels.

B. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, from manufacturer.

C. Field quality-control reports.

D. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.7 QUALITY ASSURANCE

A. Lighting fixtures shall be of specification grade and listed or labeled by Underwriters Laboratories (UL) or an approved Nationally Recognized Testing Laboratory (NRTL).

B. LED fixtures shall comply with the following:
   1. UL Standard 8750 “Light Emitting Diode Equipment for Use in Lighting Products”, IES Standard LM-79 “Electrical and Photometric Measurements of Solid-State Lighting Products”, IES Standard LM-80 “Measuring Lumen Maintenance of LED Light Sources”, and IES Standard TM-21 “Projecting Long Term Lumen Maintenance of LED Light Sources”.
   2. ANSI C78.377 “Specifications for the Chromaticity of Solid State Lighting Products” with LEDs binned within a maximum three-step MacAdam Ellipse to ensure color consistency amongst luminaries of the same type.

C. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910, complying with the IESNA Lighting Measurements Testing & Calculation Guides.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Comply with NFPA 70.

1.8 COORDINATION

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

1.9 WARRANTY

A. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

   1. Warranty Period for Emergency Lighting Unit Batteries: 5 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.
   2. Warranty Period for Self-Powered Exit Sign Batteries: Seven years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining six years.

B. For non-LED lighting fixtures and components, provide a complete warranty for parts and labor for a minimum of one year from the date of Substantial Completion.

C. For LED fixtures, lamps, drivers, and components, provide a complete warranty for parts and labor for a minimum of five years from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Provide product indicated on Fixture Schedule.

2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

A. Products: Provide product indicated on Fixture Schedule.
   1. Provide only LED fixtures with a DesignLights Consortium (DLC) listing, a U.S. Department of Energy (DOE) “LED Lighting Facts” label, or a U.S. Environmental Protection Agency (EPA) ENERGY STAR label, which have demonstrated third-party testing verification.

B. Recessed lighting fixtures shall be thermally protected.

C. LED fixtures shall be modular and allow for separate replacement of LED lamps and drivers. User serviceable LED lamps and drivers shall be replaceable from the room side.

D. Dimmable LED fixtures shall have either a 0-10 volt, 3-wire dimming driver, or a two-step (50%-100%) line voltage, two switch controlled dimming driver, as shown on the drawings.

E. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

F. Metal Parts: Free of burrs and sharp corners and edges.

G. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.

H. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

I. Diffusers and Globes:

   1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

      a. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.

b. UV stabilized.

2. Glass: Annealed crystal glass unless otherwise indicated.

J. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp and ballast characteristics:

a. "USE ONLY" and include specific lamp type.
b. Lamp diameter code (T-4, T-5, T-8, T-12, etc.), tube configuration (twin, quad, triple, etc.), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.
c. Lamp type, wattage, bulb type (ED17, BD56, etc.)
d. Start type (preheat, rapid start, instant start, etc.) for fluorescent and compact fluorescent luminaires.
e. ANSI ballast type (M98, M57, etc.) for HID luminaires.
f. CCT and CRI for all luminaires.

K. Electromagnetic-Interference Filters: Factory installed to suppress conducted electromagnetic interference as required by MIL-STD-461E. Fabricate lighting fixtures with one filter on each ballast indicated to require a filter.

2.3 BALLASTS FOR LINEAR FLUORESCENT LAMPS

A. General Requirements for Electronic Ballasts:

1. Comply with UL 935 and with ANSI C82.11.
2. Designed for type and quantity of lamps served.
3. Ballasts shall be designed for full light output unless another BF, dimmer, or bi-level control is indicated.
4. Sound Rating: Class A
5. Total Harmonic Distortion Rating: Less than 10 percent.
6. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
7. Lamp Current Crest Factor: 1.7 or less.
8. BF: 0.88 or higher.
9. Power Factor: 0.95 or higher.
10. Parallel Lamp Circuits: Multiple lamp ballasts shall comply with ANSI C82.11 - and shall be connected to maintain full light output on surviving lamps if one or more lamps fail.

B. Luminaires controlled by occupancy sensors shall have programmed-start ballasts.

C. Electronic Programmed-Start Ballasts for T8 Lamps: Comply with ANSI C82.11 and the following:
1. Automatic lamp starting after lamp replacement.

D. Electromagnetic Ballasts: Comply with ANSI C82.1; energy saving, high-power factor, Class P, and having automatic-reset thermal protection.

1. Ballast Manufacturer Certification: Indicated by label.

E. Single Ballasts for Multiple Lighting Fixtures: Factory wired with ballast arrangements and bundled extension wiring to suit final installation conditions without modification or rewiring in the field.

F. Ballasts for Low-Temperature Environments:

1. Temperatures 0 Deg F (Minus 17 Deg C) and Higher: Electronic type rated for 0 deg F (minus 17 deg C) starting and operating temperature with indicated lamp types.
2. Temperatures Minus 20 Deg F (Minus 29 Deg C) and Higher: Electromagnetic type designed for use with indicated lamp types.

G. Ballasts for Residential Applications: Fixtures designated as "Residential" may use low-power-factor electronic ballasts having a Class B sound rating and total harmonic distortion of approximately 30 percent.

H. Ballasts for Low Electromagnetic-Interference Environments: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for consumer equipment.

I. Ballasts for Dimmer-Controlled Lighting Fixtures: Electronic type.

1. Dimming Range: 100 to 5 percent of rated lamp lumens.
2. Ballast Input Watts: Can be reduced to 20 percent of normal.
3. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.
4. Control: Coordinate wiring from ballast to control device to ensure that the ballast, controller, and connecting wiring are compatible.

2.4 BALLASTS FOR COMPACT FLUORESCENT LAMPS

A. Description: Electronic-programmed rapid-start type, complying with UL 935 and with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated:

1. Lamp end-of-life detection and shutdown circuit.
2. Automatic lamp starting after lamp replacement.
3. Sound Rating: Class A.
4. Total Harmonic Distortion Rating: Less than 20 percent.
5. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
6. Operating Frequency: 20 kHz or higher.
7. Lamp Current Crest Factor: 1.7 or less.
8. BF: 0.95 or higher unless otherwise indicated.

9. Power Factor: 0.95 or higher.
10. Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.

2.5 LED Fixtures

A. LED lamps shall have a color temperature of 3500 degrees K minimum, a CRI of 80 minimum, and a lumen maintenance L70 rating of 50,000 hours minimum. See fixture schedule on electrical drawings for more information.

B. LED drivers shall be electronic-type, labeled as compliant with radio frequency interference (RFI) requirements of FCC Title 47 Part 15, and comply with NEMA SSL 1 “Electronic Drivers for LED Devices, Arrays, or Systems”. LED drivers shall have a sound rating of “A”, have a minimum efficiency of 85%, and be rated for a THD of less than 20 percent at all input voltages.

C. Dimmable LED drivers shall be 0-10V type. Dimmable LED drivers shall be capable of dimming without LED strobing or flicker across their full dimming range.

2.6 EXIT SIGNS

A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:

1. Lamps for AC Operation: Fluorescent, two for each fixture, 20,000 hours of rated lamp life.
2. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
3. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.

    a. Battery: Sealed, maintenance-free, nickel-cadmium type.
    b. Charger: Fully automatic, solid-state type with sealed transfer relay.
    c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
    d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
    e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
    f. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.

g. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.7 EMERGENCY LIGHTING UNITS

A. General Requirements for Emergency Lighting Units: Self-contained units complying with UL 924.

1. Battery: Sealed, maintenance-free, lead-acid type.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
6. Wire Guard: Heavy-chrome-plated wire guard protects lamp heads or fixtures.
7. Integral Time-Delay Relay: Holds unit on for fixed interval of 15 minutes when power is restored after an outage.
8. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
9. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.8 FLUORESCENT LAMPS

A. T8 rapid-start lamps, rated 32 W maximum, nominal length of 48 inches (1220 mm), 2800 initial lumens (minimum), CRI 75 (minimum), color temperature 3500 K, and average rated life 20,000 hours unless otherwise indicated.

B. T8 rapid-start lamps, rated 17 W maximum, nominal length of 24 inches (610 mm), 1300 initial lumens (minimum), CRI 75 (minimum), color temperature 3500 K, and average rated life of 20,000 hours unless otherwise indicated.

2.9 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Section 260529 "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch (13-mm) steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).

E. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.

F. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting fixtures:

1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
2. Install lamps in each luminaire.

B. Temporary Lighting: If it is necessary, and approved by Architect, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.

C. Lay-in Ceiling Lighting Fixtures Supports: Use grid as a support element.

1. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each fixture. Locate not more than 6 inches (150 mm) from lighting fixture corners.
2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch (20-mm) metal channels spanning and secured to ceiling tees.
4. Install at least one independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.

3.2 IDENTIFICATION

A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

B. Verify that self-luminous exit signs are installed according to their listing and the requirements in NFPA 101.

C. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.4 STARTUP SERVICE

A. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by Owner. Burn-in fluorescent and compact fluorescent lamps intended to be dimmed, for at least 100 hours at full voltage.

END OF SECTION

SECTION 284621.11

ADDRESSABLE FIRE-ALARM SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Heat detectors.
5. Notification appliances.
6. Remote annunciator.
7. Addressable interface device.
8. Digital alarm communicator transmitter.

1.2 ACTION SUBMITTALS

A. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:

    a. Trained and certified by manufacturer in fire-alarm system design.
    b. NICET-certified, fire-alarm technician; Level IV minimum.
    c. Licensed or certified by authorities having jurisdiction.

B. Product Data: For each type of product, including furnished options and accessories.

C. Shop Drawings: For fire-alarm system.

1. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
2. Include plans, elevations, sections, details, and attachments to other work.
3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
4. Detail assembly and support requirements.
5. Include voltage drop calculations for notification-appliance circuits.
6. Include battery-size calculations.
7. Include input/output matrix.

8. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements in this Specification and in NFPA 72.
9. Include performance parameters and installation details for each detector.
10. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Seismic Qualification Data: Certificates, for fire-alarm control unit, accessories, and components, from manufacturer.

C. Field quality-control reports.

D. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following and deliver copies to authorities having jurisdiction:

a. Comply with the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
b. Provide "Fire Alarm and Emergency Communications System Record of Completion Documents" according to the "Completion Documents" Article in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
c. Complete wiring diagrams showing connections between all devices and equipment.
d. Riser diagram.
e. Record copy of site-specific software.
f. Provide "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:

1) Equipment tested.
2) Frequency of testing of installed components.
3) Frequency of inspection of installed components.
4) Requirements and recommendations related to results of maintenance.
5) Manufacturer's user training manuals.

g. Manufacturer's required maintenance related to system warranty requirements.

h. Abbreviated operating instructions for mounting at fire-alarm control unit and each annunciator unit.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm **Level IV** technician.

C. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL (nationally recognized testing laboratory) and: Obtain certification according to NFPA 72 by CSFM.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail in materials or workmanship within specified warranty period.

1. Warranty Extent: All equipment and components not covered in the Maintenance Service Agreement.
2. Warranty Period: Seven years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Source Limitations for Fire-Alarm System and Components: Components shall be compatible with, and operate as an extension of, existing system. Provide system manufacturer's certification that all components provided have been tested as, and will operate as, a system.

B. Noncoded, UL-certified addressable system, with multiplexed signal transmission and horn/strobe evacuation.

C. Automatic sensitivity control of smoke detectors.

D. All components provided shall be listed for use with the selected system.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:

1. Manual stations.
2. Heat detectors.
3. Smoke detectors.
4. Automatic sprinkler system water flow.
5. Fire-extinguishing system operation.
6. Fire standpipe system.
7. Dry system pressure flow switch.

B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm notification appliances.
2. Identify alarm and specific initiating device at fire-alarm control unit and remote annunciators.
3. Transmit an alarm signal to the remote alarm receiving station.
4. Unlock electric door locks in designated egress paths.
5. Release fire and smoke doors held open by magnetic door holders.
6. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
7. Activate preaction system.
8. Activate emergency shutoffs for gas and fuel supplies.
9. Record events in the system memory.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Valve supervisory switch.
2. High- or low-air-pressure switch of a dry-pipe or preaction sprinkler system.
3. Loss of communication with any panel on the network.

D. System trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of communication with any addressable sensor, input module, relay, control module, or remote annunciator.
4. Loss of primary power at fire-alarm control unit.
5. Ground or a single break in internal circuits of fire-alarm control unit.

6. Abnormal ac voltage at fire-alarm control unit.
7. Break in standby battery circuitry.
8. Failure of battery charging.
9. Abnormal position of any switch at fire-alarm control unit or annunciator.

E. System Supervisory Signal Actions:

1. Initiate notification appliances.
2. Identify specific device initiating the event at fire-alarm control unit and remote annunciators.
3. After a time delay of 199 seconds, transmit a trouble or supervisory signal to the remote alarm receiving station.

2.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Fire-alarm control unit and raceways shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2.4 FIRE-ALARM CONTROL UNIT

A. General Requirements for Fire-Alarm Control Unit:

1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864.
2. Addressable Initiation Device Circuits: The FACP shall indicate which communication zones have been silenced and shall provide selective silencing of alarm notification appliance by building communication zone.
3. Addressable Control Circuits for Operation of Notification Appliances and Mechanical Equipment: The FACP shall be listed for releasing service.

B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type, 80 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.

C. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits:

1. Pathway Class Designations: NFPA 72, Class B**.**
2. Pathway Survivability: Level 1.

D. Notification-Appliance Circuit:

1. Audible appliances shall sound in a three-pulse temporal pattern, as defined in NFPA 72.
2. Where notification appliances provide signals to sleeping areas, the alarm signal shall be a 520-Hz square wave with an intensity 15 dB above the average ambient sound level or 5 dB above the maximum sound level, or at least 75 dBA, whichever is greater, measured at the pillow.
3. Visual alarm appliances shall flash in synchronization where multiple appliances are in the same field of view, as defined in NFPA 72.

E. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

F. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory signals, supervisory and digital alarm communicator transmitters, and digital alarm radio transmitters shall be powered by 24-V dc source.

1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.

G. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

2.5 MANUAL FIRE-ALARM BOXES

A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38.

1. Single-action mechanism, plastic-rod, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
2. Station Reset: Key- or wrench-operated switch.

2.6 SYSTEM SMOKE DETECTORS

A. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.
2. Detectors shall be two-wire type.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type, indicating detector has operated. Number of settable levels in fire-alarm control unit varies among manufacturers and between detector types. Indicate specific number of levels on Drawings or in "Remarks" column of a detector schedule.

a. Multiple levels of detection sensitivity for each sensor.
b. Sensitivity levels based on time of day.

B. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

a. Primary status.
b. Device type.
c. Present average value.
d. Present sensitivity selected.

2.7 HEAT DETECTORS

A. General Requirements for Heat Detectors: Comply with UL 521.

1. Temperature sensors shall test for and communicate the sensitivity range of the device.

B. Heat Detector, Combination Type: Actuated by either a fixed temperature or a rate of rise.

1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.8 Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.9 NOTIFICATION APPLIANCES

A. General Requirements for Notification Appliances: Connected to notification-appliance signal circuits, zoned as indicated, equipped for mounting as indicated, and with screw terminals for system connections.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.

B. Chimes: Vibrating type.

C. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464.

D. Visible Notification Appliances: Xenon strobe lights complying with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch high letters on the lens.

1. Mounting: Wall mounted unless otherwise indicated.
2. Flashing shall be in a temporal pattern, synchronized with other units.
3. Strobe Leads: Factory connected to screw terminals.
4. Mounting Faceplate: Factory finished, red.

2.10 REMOTE ANNUNCIATOR

A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.

1. Mounting: Surface cabinet, NEMA 250, Type 1.

B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.11 ADDRESSABLE INTERFACE DEVICE

A. General:

1. Include address-setting means on the module.
2. Store an internal identifying code for control panel use to identify the module type.
3. Listed for controlling HVAC fan motor controllers.

B. Monitor Module: Microelectronic module providing a system address for alarm-initiating devices for wired applications with normally open contacts.

2.12 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632.

B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture two telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.

C. Local functions and display at the digital alarm communicator transmitter shall include the following:

1. Verification that both telephone lines are available.

2. Programming device.
3. LED display.
4. Manual test report function and manual transmission clear indication.
5. Communications failure with the central station or fire-alarm control unit.

D. Digital data transmission shall include the following:

1. Address of the alarm-initiating device.
2. Address of the supervisory signal.
3. Address of the trouble-initiating device.
4. Loss of ac supply.
5. Loss of power.
6. Low battery.
7. Abnormal test signal.
8. Communication bus failure.

E. Secondary Power: Integral rechargeable battery and automatic charger.

F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."

B. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.

C. Equipment Mounting: Install fire-alarm control unit on finished floor.

1. Comply with requirements for seismic-restraint devices specified in Section 270548.16 "Seismic Controls for Communications Systems."

D. Install wall-mounted equipment, with tops of cabinets not more than 78 inches (1980 mm) above the finished floor.

1. Comply with requirements for seismic-restraint devices specified in Section 270548.16 "Seismic Controls for Communications Systems."

E. Manual Fire-Alarm Boxes:

1. Install manual fire-alarm box in the normal path of egress within 60 inches (1520 mm) of the exit doorway.
2. Mount manual fire-alarm box on a background of a contrasting color.

3. The operable part of manual fire-alarm box shall be between 42 inches (1060 mm) and 48 inches (1220 mm) above floor level. All devices shall be mounted at the same height unless otherwise indicated.

F. Smoke- or Heat-Detector Spacing: Comply with NFPA 72.

G. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.

H. Remote Status and Alarm Indicators: Install in a visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.

I. Audible Alarm-Indicating Devices: Install not less than 6 inches (150 mm) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Install all devices at the same height unless otherwise indicated.

J. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches (150 mm) below the ceiling. Install all devices at the same height unless otherwise indicated.

K. Device Location-Indicating Lights: Locate in public space near the device they monitor.

3.2 PATHWAYS

A. Pathways shall be installed in steel conduit.

B. All fire alarm systems pathways shall be painted red enamel (including but not limited to junction boxes, pullboxes, fittings, and connections).

3.3 CONNECTIONS

A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Section 087100 "Door Hardware." Connect hardware and devices to fire-alarm system.

1. Verify that hardware and devices are listed for use with installed fire-alarm system before making connections.

B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 36 inches (910 mm) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.

1. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.

2. Supervisory connections at valve supervisory switches.
3. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.

3.4 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 270553 "Identification for Communications Systems."

B. Install framed instructions in a location visible from fire-alarm control unit.

3.5 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

B. Ground shielded cables at the control panel location only. Insulate shield at device location.

3.6 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by authorities having jurisdiction and Inspector of Record.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Visual Inspection: Conduct visual inspection prior to testing.
    a. Inspection shall be based on completed record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" table in the "Documentation" section of the "Fundamentals" chapter.
    b. Comply with the "Visual Inspection Frequencies" table in the "Inspection" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
2. System Testing: Comply with the "Test Methods" table in the "Testing" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
3.
4. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
5. Test audible appliances for the private operating mode according to manufacturer's written instructions.

6. Test visible appliances for the public operating mode according to manufacturer's written instructions.
7. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" section of the "Fundamentals" chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

C. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

D. Fire-alarm system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

F. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

G. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.7 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.

B. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.

C. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.

1. Upgrade Notice: At least 30 days to allow Owner to schedule access to system and to upgrade computer equipment if necessary.

3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION

SECTION 31 23 17

TRENCHING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Excavate trenches for utilities.

B. Compacted bedding.

C. Backfilling and compaction to required elevations.

D. Slurry concrete.

1.02 REFERENCE STANDARDS

A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.

B. ASTM C150 - Portland Cement.

C. ASTM C494 - Chemical Admixtures for Concrete.

D. ASTM D1557 - Laboratory compaction characteristics of soil using modified effort.

E. SSPWC - Standard Specifications for Public Works Construction, Latest Edition.

F. California Code of Regulations, Title 8, Industrial Relations, Construction Safety Orders, Division 1, Chapter 4, Subchapter 4, Article 6 Excavations.

G. Cal-OSHA: California Occupational Safety and Health Act, Title 8, Division 1, Chapter 3.2.

H. California Public Contract Code, Section 7104 - Public Works Contracts for Digging Trenches or Excavations; Notice on Discovery of Hazardous Waste or Other Unusual Conditions; Investigations; Change Orders; Effect on Contract.

I. California Labor Code, Section 6705 - Public Works Contracts requiring detailed plans for shoring, bracing, sloping, indicating protection from caving ground for trenching work in excess of 5’ deep and contract amounts stipulated therein.

PART 2 - PRODUCTS

2.01 FILL AND BEDDING MATERIALS

A. Sand: Sand shall consist of natural or manufactured granular material, or a combination thereof, free of deleterious amounts of organic material, mica, loam, clay and other substances not suitable for the purpose intended. Conform to Subsection 200-1.5.5, SSPWC, for gradation as required for Portland Cement Concrete, sand must achieve compaction of a minimum 90 percent.

B. Imported Fill: Granular, free of debris, no gravel larger than 3 inches in any dimension, non-expansive, approved by the Architect prior to placement on the site.

C. Slurry Concrete:
1. Slump: Between 4 inches and 6 inches.
2. Aggregate: 40 percent sand by weight, 60 percent pea gravel, minimum 1/4 inch, maximum 5/8 inch.
3. Portland Cement: ASTM C150, 2-sack mix (2 sacks of cement per cubic yard).
4. Admixture: Calcium Chloride free, in proportions not to exceed the manufacturer's recommendations.
5. Artificial Coloring: ASTM C494. Mix in Mapico Red pigment, proportions as recommended by the manufacturer, L.M. Scofield or equal.
6. Sufficient water shall be added to produce a fluid, workable mix that will flow and can be pumped without segregation of aggregate. Material shall be mechanically mixed until the cement and water are thoroughly dispersed.

D. Stockpiled Fill: Onsite soils, stored separately on the site, approved for re-use by the Architect.

2.02 ACCESSORIES

A. Underground Warning Tape: Metallic Detection Tape, aluminum core, 6 inches wide AASHTO specification colors, by Safety Sign Company, Cleveland, OH, or equal.

B. Color Coding and Lettering: as required for type of underground utility.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify fill material to be reused is acceptable to the Architect .

3.02 PREPARATION

A. Identify required lines, levels, contours and datum.

B. Backfill with approved fill and compact to density equal to or greater than requirements for subsequent backfill material.

C. Prior to commencement of trenching operations, notify Underground Service Alert of Southern California (800) 422-4133, , Monday through Friday, 7:00 A.M. to 5:00 P.M.

3.03 EXCAVATION

A. Conform to Construction Safety Orders, Title 8, CCR, For Sloping, Benching, Shoring, Bracing, Protective Systems, and Shafts.

B. Conform to Section 7104, Public Contract Code. Promptly notify Owner of any contact with hazardous materials or differing conditions.

C. Conform to Section 6705, Labor Code. Provide detailed plan showing the design of shoring, bracing, sloping, or other provisions to be made for worker protection from the hazard of caving ground during the excavation of trenches.

D. Excavate subsoil required for utilities. Trenches shall be level or parallel to finish grade unless designated on drawings to be installed to specific gradient.

E. Cut trenches sufficiently wide to enable installation of utilities and allow inspection.

F. Water, storm drainage piping located in the same trench shall be separated by 12 inches horizontally and vertically, and water line shall be placed on a solid shelf excavated on one side of the common trench. Cross-over water lines shall also be separated 12 inches vertically from storm drainage pipe.

G. Water and sewer piping shall not be located in the same trench and they shall be separated by 12 inches horizontally and 12 inches vertically.

H. Excavation shall not interfere with normal 45 degree bearing splay of foundations. Parallel trenches, no closer than 18 inches from building foundations.

I. Remove lumped subsoil, boulders and rock.

J. Correct unauthorized excavation.

K. Stockpile approved excavated material in area designated on site and remove excess material not being used from site.

3.04 BEDDING

A. Support pipe and conduit during placement and compaction of bedding fill. Provide uniform bearing along entire length. Conform to Section 306, SSPWC.

B. Bedding: Place and compact materials in continuous layers not exceeding 6 inches compacted depth, ASTM D1557.

3.05 BACKFILLING

A. Backfill trenches to contours and elevations with unfrozen materials.

B. Soil Fill over Bedding: Place and compact material in continuous layers as scheduled, compacted to ASTM D1557.

C. Employ placement method that does not disturb or damage conduit, ducts or piping in trench.

D. Maintain optimum moisture content of backfill materials to attain required compaction density. When operations are interrupted by rain, do not resume Work until field tests indicate that moisture content and density of fill are as previously specified.

E. Remove surplus backfill materials from site and dispose legally.

F. Leave fill material stockpile areas completely free of excess fill materials.

G. Minimum Cover Over Piping, Conduits or Duct Banks: 24 inches.

H. Lay out and install or otherwise confirm invert elevations of all gravity flow systems to avoid conflict with other sub-surface structures or utilities of any kind. Adjust elevations or layout of pipes, conduits or duct banks to permit the required gravity flow.

3.06 TOLERANCES

A. Top Surface of Backfilling Under Paved Areas: 0.2 ft from required elevations.

B. Top Surface of General Backfilling: Plus or minus 0.2 ft from required elevations.

3.07 FIELD QUALITY CONTROL

A. Tests, analysis and compaction of fill material will be performed in accordance with ASTM D1557.

B. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

3.08 PROTECTION OF FINISHED WORK

A. Protect finished Work.

B. Recompact fills subjected to vehicular traffic.

3.09 TEMPORARY PROTECTION OF UNFINISHED WORK

A. Trenching for placement of underground utilities shall be covered and protected with steel trench plates during non-work hours [and during school session hours.] Adequate warnings and protection indication of open trenches during work hours must be provided for project safety.

3.10 SCHEDULE

A. Storm and Sanitary Piping:

1. Bedding Fill: Sand, minimum thickness below piping 0.4 times outside diameter of pipe but no less than 4 inches. Minimum thickness above top of piping, 12 inches, compacted to 90 percent.
2. Cover with stockpiled fill in 8-inch lifts to specified subgrade elevations, compact to 90 percent or to 95 percent under vehicle traffic-supporting paved areas.
3. Fill: Slurry concrete, 6" cover at top, bottom and sides of pipes at exterior paved areas (at vehicle traffic) where minimum fill cover is less than 12" below finished elevation of paving. Slurry per Section 32 13 13 Sitework concrete.
4. Bury warning tape marked "Caution Sewer Line" 12 inches above all concrete-encased piping. Align tape parallel to and within 3 inches of the centerline of the piping.

B. Power Ducts: Concrete Encased
1. Fill: Slurry concrete, 3 inches cover at top, bottom, between conduits and sides of duct bank.
2. Fill: Slurry concrete, 6 inches cover at top, bottom and sides of duct bank conduit at exterior paved areas where minimum fill cover is less than 24” below finished elevation of paving, and less than 12" below finished elevations of interior floor slabs and at building footings where conduit is in the footing structural splay. Slurry per Section 32 13 13 Sitework concrete.
3. Install two No. 4 bars in slurry concrete at top of bank under paved areas, minimum 3 inch concrete cover.
4. Cover with stockpiled fill in 6-inch lifts to specified subgrade elevation, compact to 90 percent, or to 95 percent under traffic-supporting paved areas.
5. Bury warning tape marked "Caution Buried High Voltage Line" 12 inches above all concrete-encased duct banks. Align tape parallel to and within 3 inches of the centerline of the duct bank.

C. Water Piping and Gas Piping:
1. Bedding Fill: Sand, minimum thickness below piping 0.4 times outside diameter of pipe but not less than 4". Minimum thickness above top of piping, 6 inches, compacted to 90 percent.
2. Fill: Slurry concrete, 6 inches cover at top, bottom and sides of pipes at exterior paved areas where minimum fill cover is less than 24" below finished elevation of paving, and less than 12" below finished elevations of interior floor slabs and at building footings where piping is in the footing structural splay. Slurry concrete per Section 32 13 13 Sitework concrete.
3. Cover with stockpiled fill in 6-inch lifts to specified subgrade elevation, compact to 90 percent, or 95 percent under traffic-supporting paved areas.
4. Observe joints at pressure tests.
5. Bury warning tape marked "Caution Buried Gas (or "Pipeline") Line" 12 inches above all trenching. Align tape parallel to and within 3 inches of the centerline of trench.

D. Fire Lines:
1. Bedding Fill: Manufactured Sand, minimum 6" thickness under piping, minimum thickness above top of piping and sides, 6", compact to 90 percent.
2. Fill: Slurry concrete, 6" cover at top pipes at exterior paved areas where minimum fill cover is less than 24" below finished elevation of paving. Slurry concrete per Section 32 13 13 Sitework concrete.

3. Cover with stockpiled fill in 6-inch lifts to specified subgrade elevation, compact to 90 percent, or 95 percent under traffic-supporting paved areas.
4. Bury warning tape marked "Caution Buried Pipeline" 12 inches above all trenching. Align tape parallel to and within 3 inches of the centerline of trench.

E. Low Voltage Conduits and Communications: Direct Burial Minimum trench depth 36 inches.
1. Bedding Fill: Sand, 6 inches at bottom, sides and 12 inches on top, compacted to 95 percent.
2. Cover with stockpiled fill in 6-inch lifts to specified subgrade elevation, compact to 90 percent, or 95 percent under traffic-supporting paved areas.
3. Bury warning tape marked "Caution Buried Communication Line Below" 12 inches above conduits. Align tape parallel to and within 3 inches of the centerline of conduits.

END OF SECTION

SECTION 32 13 13

SITEWORK CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes
   1. Cast-In-Place concrete pedestrian paving and sidewalks.
   2. Site concrete repair.

B. Related Sections:
   1. Section 31 23 17, Trenching

1.02 REFERENCE STANDARDS

A. Conform to current adopted reference standards by date of issue of the current code cycle and the date of the Contract Documents.

B. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials.

C. ACI 224.3R-95 - Joints in Concrete Construction

D. ACI 318-14 - Building Code Requirements for Structural Concrete and Commentary, 2008 Edition.

E. ACI 301 - Structural Concrete for Buildings.

F. ASTM - American Society for Testing and Materials
   1. ASTM A185 - Steel Welded Wire Reinforcement, Plain, for Concrete
   2. ASTM A615 - Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
   3. ASTM C33 - Concrete Aggregates
   4. ASTM C94 - Ready-Mixed Concrete
   5. ASTM C150 - Portland Cement
   6. ASTM C171 - Sheet Materials for Curing Concrete
   7. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete
   8. ASTM C920 - Elastomeric Joint Sealants
   9. ASTM C979 - Pigments for Integrally Colored Concrete
   10. ASTM C1107 - Packaged Dry, Hydraulic - Cement Grout (Non-Shrink)
   11. ASTM D1751 - Preformed Expansion Joint Fillers for Concrete, Paving and Structural Construction

G. CBC - 2016 California Building Code and Supplements
   1. CBC-11 - CBC Chapter 11B, Accessibility to Public Buildings, Public Accommodations, Commercial Facilities and Publicly Funded Housing
   2. CBC-17 - CBC Chapter 17A, Structural Tests and Special Inspections
   3. CBC-19 - CBC Chapter 19A, Concrete DSA

1.03 SUBMITTALS

A. Placement Schedule for approval: Provide details or sketches showing location of each placement of concrete Work. Do not deviate from location of expansion joints or scorelines.

B. Design mix for each concrete mix.

C. Steel reinforcement shop drawings, including materials, grade, bar schedules, spacing, bent bar diagrams, arrangement and supports.

D. Submit contraction (crack control) joint, expansion, isolation and construction joint layout to Architect for approval.

E. Product data on joint filler, sealants, curing compounds and reinforcing.

F. Project Record Documents
1. Accurately record actual locations of embedded sleeves, utilities and components that are concealed from view.

1.04 REGULATORY REQUIREMENTS

A. Pedestrian walks, plazas and paving shall comply with CBC Chapter 11B. Portland Cement concrete paving shall be stable, firm, and slip resistant and shall comply with CBC Sections 11B-302 and 11B-403.

1.05 QUALITY ASSURANCE

A. Maintain one copy of all records on site.

B. Acquire cement and aggregate from same source for all Work.

C. Conform to ACI 318-14 Chapter 5.13, California Building Code, when placing concrete during hot weather.

D. Conform to ACI 318-14 Chapter 5.12, California Building Code, when placing concrete during cold weather. No placement of concrete permitted below 50 degrees Fahrenheit.

PART 2 - PRODUCTS

2.01 CONCRETE MATERIALS

A. Cement: ASTM C150 - Type I - Normal or Type II - Moderate, Portland Cement type, from one manufacturing plant only. .

B. Aggregates: ASTM C33, single source for all materials. Maximum size aggregate: 1 inch.

C. Non-Shrink Grout: ASTM C1107, premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents; capable of developing minimum compressive strength of 4,000 psi in 24 hours and 7,500 psi in 7 days unless otherwise indicated on Drawings; of consistency suitable for application and a 30 minute working time.

D. Crushed Aggregate Base: Crushed rock and rock dust conforming to requirements of Section 200-1.2, SSPWC, with 3/8 inch sieve requirement waived, or Class 2 aggregate base as defined in Section 26, CSS.

2.02 ACCESSORIES

A. Expansion Joints:
1. Expansion Joint Filler - ASTM D1751: Closed cell, 1/2 inch thick; DECK-O-FOAM by W. R. Meadows, Dayton Superior or equal.
2. Joint Devices: Integral extruded polystyrene plastic; 1/2 inch max. thick, with removable top strip exposing sealant trough; Snap Cap Expansion Joint Cap by W. R. Meadows or equal.
3. Sealant: Polyurethane two-component type, self-leveling, for level surface application, UREXPAN NR-200 or DYNATRED for sloped surfaces, manufactured by Pecora Corp., Harleysville PA, or equal. Color shall be selected by Architect from manufacturer's standard list of colors.
4. Primer: As recommended by sealant manufacturer.
5. Joint Backing: ASTM C1330, Cylindrical, Type C, closed cell, polyethylene backer rod; oversized 30 to 50 percent larger than joint width. Green Rod by Nomaco Inc. or equal.

B. Highway Fiber Expansion Joint: 1/2 inch max. thick; FIBER EXPANSION JOINT by American Highway Technology, Kankakee, IL, or equal.

2.03 CONCRETE MIX

A. Mix and deliver concrete in accordance with Section 1905A, California Building Code. Deliver concrete in transit mixers only. Mix concrete for 10 minutes minimum at a peripheral drum speed of approximately 200 feet per minute. Mix at jobsite minimum 3 minutes. Discharge loads in less than 1-1/2 hours or under 300 revolutions of the drum, whichever comes first, after water is first added.
1. Design Mix:
   a. Conform to ACI 318-14 Chapter 5.8 for Proportioning on the basis if field experience or trial mixtures method.
   b. Conform to ACI 318-14 Chapter 5.8 for Selection of concrete proportions method. Selection of concrete proportions and ingredients for design mix by a DSA -approved Testing Laboratory and certified by a registered civil engineer licensed in California.
2. Do not exceed 0.50 water-cement ratio by weight for slabs and for other concrete.
3. Quantities of Materials: Weighmaster's records not required for sitework concrete.
4. Required Strength: Minimum 3,000 psi for sitework concrete.

2.04 REINFORCEMENT

A. Reinforcing Steel: ASTM A615; deformed billet steel bars, in grades as follows, and conforming to CBC-19, Section 1903A.
   1. For No. 4 and larger bars, use 60 ksi yield grade.
   2. For ties and stirrups, and No. 3 and smaller bars, use 40 ksi yield grade.
   3. For welded bars, use ASTM A706 60 ksi yield grade.

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

C. Dowels: ASTM A615; 60 ksi yield grade, plain steel, uncoated finish.

2.05 FORMS

A. Conform to ACI 318-14 Chapter 6.

B. Plywood Forms: APA - Medium density overlay, Group 1, Exterior, PS-1, for exposed surfaces. APA Plyform B-B, Class 1, Exterior, PS-1 for unexposed surfaces.
   1. Use flexible or curved forms for curves with a radius 100 feet or less.

C. Lumber: Douglas Fir species, construction grade, Surfaced Lumber, with grade stamp clearly visible for smooth and straight exposed surface.

D. Form Release Agent; commercially formulated form-release agent that will not bond with, stain or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.06 CURING MATERIALS

A. Polyethylene Film ASTM C171; 10 mil thick, clear, manufactured from virgin resin with no scrap or additives, manufactured by Burke-Edoco, Long Beach, CA, or equal as approved in accordance with Division 01, General Requirements for Substitutions.

B. Water: Potable and not detrimental to concrete.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify site conditions.

B. Verify requirements for concrete cover over reinforcement.

C. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely and will not cause hardship in placing concrete.

3.02 PREPARATION

A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.

B. In locations where new concrete is doweled to existing Work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

C. Ensure sub-base or base materials have been compacted or otherwise treated.
   1. Remove existing natural soils to depth required for sitework concrete thickness and elevations.
   2. Remove unsuitable soil, backfill with clean compactable soil or approve granular material to required elevations.
   3. Scarify exposed natural sub-base to depth of 6 inches. Bring to optimum moisture content and re-compact to 90 percent in accordance with ASTM D 1557.
   4. Add approved aggregated base to required elevation in 6 inch maximum lifts. Bring to optimum moisture content and compact to 90 percent in accordance with ASTM D1557.

3.03 PLACING CONCRETE (GENERAL)

A. Convey and deposit concrete in accordance with ACI 318-14 Chapter 5.9 and 5.10. Remove loose dirt from excavations.

B. Notify Job Inspector minimum 24 hours prior to commencement of operations.

C. Ensure reinforcement, inserts, embedded parts, formed joint fillers, joint devices and accessories are not disturbed during concrete placement.

D. Install joint fillers, primer and sealant in accordance with manufacturer's instructions.

E. Place concrete continuously between predetermined expansion joints.
   1. Install expansion joints at vertical concrete walls at 24 feet on center unless noted otherwise on drawings.

F. Do not interrupt successive placement; do not permit cold joints to occur. Avoid segregation of materials. Perform tamping and vibrating so as to produce a dense, smooth application free of rock pockets and voids. Do not use vibrators to move concrete horizontally.

G. Do not allow concrete to fall free from any height which will cause materials to segregate. Maximum height of free fall permitted in any case: 5 feet.

H. Defective Installation: Repair and clean at Contractor's expense all concrete damaged or discolored during construction. Where concrete requires repair before acceptance, the repair shall be made by removing and replacing entire section between joints and not by refinishing the damaged portion.

I. Proper curing of concrete surfaces is the responsibility of the Contractor. Concrete failing to meet specified strength shall be removed and replaced.

3.04 ON-SITE CONCRETE SIDEWALKS, PEDESTRIAN PAVED AREAS

A. Forms, Wood: Free from warp, with smooth and straight upper edges, surfaced one side, minimum thickness 1-1/2 inches adequate to resist springing or deflection from placing concrete.

B. Forms, Metal: Gauge thickness sufficient to provide rigidity and strength equivalent to wood.

C. Reinforcing Steel: #4 bars, place bars at 12 inches on center each way for sidewalks and paved areas and #4 bars for edges unless otherwise indicated on Drawings.

D. Concrete Placement: Dampen subgrade to retain moisture in concrete mix. Tamp and spade to consolidate concrete for entire length of pour. Strike off upper surface to specified grades.

E. Isolation Joints: Locate at slabs abutting vertical concrete surfaces and as patterned on drawings. Install vertically, full depth of concrete with preformed joint filler recessed for plastic cap at 1/2 inch depth at top for sealant application.
   1. Doweled Isolation Joints at Heavy Vehicle Driveways and Parking: At abutting building foundations; provide 1/2-inch diameter smooth steel dowels 14 inches long, one end of dowel lubricated and set in capped sleeve to allow for longitudinal movement, spaced at 24 inches on center maximum, 6 inches from edges.

F. Contraction/Crack Control Joints: At 8 feet each way at concrete paved areas, and 5 feet at sidewalks, tool joint with 1/2 inch radius, depth 1/4 the thickness of slab but not less than 1 inch deep. Refer to drawings for required design patterns.

G. Finish:
   1. Portland cement paving shall be stable, firm, and slip resistant and shall comply with CBC Sections 11B-302 and 11B-403.
   2. Screed concrete to required grade, float to a smooth, flat, uniform surface. Edge all headers to 1/2 inch radius. Edge expansion joints to 1/4 inch radius. Steel trowel to hard surface.
   3. Medium Broom Finish: After final troweling, apply a medium broom finish transverse to centerline or direction of traffic.
   4. Surface Cross slopes: surface cross slopes shall not exceed one unit vertical in 50 units horizontal (2-percent).

H. Curing: Cure surfaces utilizing one of the following methods:
   1. Spraying: Spray water over slab areas and maintain wet for 7 days, use burlap mats.
   2. Spread polyethylene film over slab areas, lapping edges and sides, minimum 6 inches and sealing with pressure sensitive tape; cover with plywood or otherwise protect film from damage; maintain in place for 7 days.

3. Apply liquid curing compound at rate of 200 sf per gallon, using power sprayer equipped with agitator. Do not apply liquid curing compound to surfaces scheduled to receive paving units of any kind.

I. Remove expansion joint plastic caps. Prime both sides of joint and apply self-leveling sealant per Section 07 92 00. Provide smooth concave surface.

3.05 TOLERANCES

A. Construction tolerances shall not violate dimensions, grades, slopes required by CBC for accessibility requirements. Adjust work accordingly to comply with requirements.

B. Comply with tolerances of ACI 117 and as follows (tolerances may not exceed CBC maximum or minimum):
1. Maximum deviation of 1/8 inch in 10 feet.
2. Elevation: 1/4 inch.
3. Thickness: Plus 3/8 inch, minus 1/4 inch.
4. Surface: Gap below 10-foot- long, unleveled straightedge not to exceed 1/8 inch.
5. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch.
6. Vertical Alignment of Tie Bars and Dowels: 1/4 inch.
7. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: 1/2 inch.
8. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel 1/4 inch per 12 inches.
9. Joint Spacing: 3 inches.
10. Contraction Joint Depth: Plus 1/4 inch, no minus.
11. Joint Width: Plus 1/8 inch, no minus.

END OF SECTION