Project Manual

for

EASTWOOD ELEMENTARY SCHOOL MODERNIZATION

for

WESTMINSTER SCHOOL DISTRICT

03-31-2023

PBK Project No. 220528
DSA Project A# 04-121952

Stamps & Seals

Architectural



Structural



Mechanical



Electrical



IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
APP: 04-121953 INC:
REVIEWED FOR
SS ☑ FLS ☑ ACS ☑
DATE: 12/08/2023

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SECTION 01 11 00
SUMMARY OF WORK

PART 1 – GENERAL

1.01 SUMMARY

A. The Project consists of Modernization to Finley Elementary School for Westminster School District, in compliance with the Contract Documents and Code requirements.

B. The furnishing of all labor, materials, equipment, services, and incidentals necessary for Work of Eastwood Elementary School Modernization, 13552 University St, Westminster, CA 92683

C. The Project is to include, but not limited to:

a. HVAC installation in all classrooms and Administration offices located in permanent buildings on site.

b. Fire alarm system upgrade in all classrooms, offices and support spaces (NOT incl. Auditorium, Cafeteria & Kitchen) as well as all portable classroom buildings on site.

c. Utility service upgrades (e.g., electrical, water, sanitary, low voltage, etc.) as required to support HVAC installation.

d. Interior/exterior finish upgrade (e.g., ceiling tile, paint etc.) that are impacted by the HVAC installation and as directed by the District.

e. Paint the exterior of all buildings.

f. Administration building minor remodeling including new walls and finishes.

1.02 RELATED DOCUMENTS

A. Construction Services Agreement

B. Drawings

C. Specifications

1.03 USE OF PREMISES

A. CONTRACTOR shall coordinate the Work of all trades, with OWNER, DISTRICT REPRESENTATIVE, and/or Separate Work Contract. CONTRACTOR shall sequence, coordinate, and perform the Work to impose minimum impact on the operation and use of the facilities and/or Project site. CONTRACTOR shall install all necessary protection for existing improvements, Project site, property, and new Work against dust, dirt, weather, damage, vandalism, and maintain and relocate all protection to accommodate progression of the Work.

B. CONTRACTOR shall confine entrance and exiting to the Project site and/or facilities to routes designated by the DISTRICT REPRESENTATIVE.

C. CONTRACTOR to coordinate with DISTRICT REPRESENTATIVE to obtain keys. CONTRACTOR will be required to sign a release form. Key requests need to be made three (3) days in advance.

D. Obtain and pay for the use of field offices, storage, work areas, or parking needed for operations or CONTRACTOR'S employees. Obtain and pay for all public right of way fees associated with utility connections, street use permits and protective canopies over public right of ways.

E. Within existing facilities, OWNER may remove portable equipment, furniture, and supplies from Work areas prior to the start of Work. CONTRACTOR shall cover and protect

remaining items in areas of the Work.

F. Provide and maintain unimpeded access for police, fire fighting, or rescue equipment.

G. CONTRACTOR shall furnish, install, and maintain adequate supports, shoring, and bracing to preserve structural integrity and prevent collapse of existing improvements and/or Work modified and/or altered as part of the Work.

H. CONTRACTOR shall secure site, building entrances, exits, and Work areas with locking devices in an acceptable manner to DISTRICT REPRESENTATIVE.

I. CONTRACTOR assumes custody and control of OWNER property, both fixed and portable, remaining in existing facilities vacated during the Work.

J. CONTRACTOR shall cover and protect surfaces of rooms and spaces in existing facilities turned over for the Work, including OWNER property remaining within as required to prevent soiling or damage from dust, dirt, water, and/or fumes. CONTRACTOR shall protect areas adjacent to the Work in a similar manner. Prior to OWNER occupancy, CONTRACTOR shall clean all surfaces including OWNER property.

K. CONTRACTOR shall protect all surfaces, coverings, materials, and finished Work from damage. Mobile equipment shall be provided with pneumatic tires.

L. District's occupancy: The District reserves the right to place and install equipment in areas of the Project prior to Beneficial Occupancy provided that it doesn't interfere with the completion of the Work. This partial occupancy shall not constitute acceptance of the Work by the OWNER.

M. CONTRACTOR shall not permit the use of portable and/or fixed radio's or other types of sound producing devices including Walkman's, iPod's, and similar devices.

1.04 EXISTING CONDITIONS

A. CONTRACTOR shall document the existing site and produce still photographs or video recording on DVD, sufficiently detailed, of existing conditions of adjoining construction, roads, and site improvements that might be misconstrued as damage caused by construction operations.

B. CONTRACTOR shall protect items indicated to remain against damage and soiling during construction.

C. CONTRACTOR shall sequence work in a manner that will prevent any damage upon new construction elements.

D. CONTRACTOR shall replace any items damaged during construction.

1.05 WORK NOT IN CONTRACT

A. The term "NIC" shall be construed to mean that portions of the Project are not to be furnished, installed or performed by the CONTRACTOR. The term shall mean "Not in Contract" or Not a Part of the Work to be performed by the CONTRACTOR" except that coordination and installation of certain NIC items specified shall be the CONTRACTOR'S responsibility. District will award separate contracts for products and installation for the following work and other work as may be indicated on Drawings as NIC (Not in Contract), including:

a. Tests and inspections specified in the Contract Documents.

b. Television System: Cable antenna television (CATV) system, including satellite TV dish, equipment, outlets and monitors, including mounting brackets. Contract shall include conductors built into building construction to service television system, as indicated on Drawings and as specified.

c. Telephone System: Private branch exchange (PBX) telephone equipment, conductors and outlets, and telephone instruments, from point of service at

telephone terminal board and using empty conduit included in the Contract. Work under the Contract includes conductors built into building construction to service telephone system, as indicated on Drawings and as specified.

B. When the work of this Contract requires the CONTRACTOR to make allowance for the above in his work, and to provide supports, power, conduits, stub-outs and other services to these items, the drawings, manufacturer's data and other information necessary for the CONTRACTOR'S work will be provided by the OWNER upon request.

1.06 OWNER FURNISHED CONTRACTOR INSTALLED (OFCI) MATERIALS

A. Certain materials identified in the Contract Documents as OWNER Furnished CONTRACTOR Installed (OFCI) will be delivered to the Project site by the OWNER. CONTRACTOR shall unload, store, uncrate, assemble, install, and connect OWNER supplied materials.

B. One-Hundred and Twenty days before the date the CONTRACTOR needs to have the OFCI materials on site, CONTRACTOR shall notify OWNER of the scheduled date for needed OFCI materials. Upon delivery to Project site, CONTRACTOR shall store OFCI materials inside rooms and/or protected spaces and will be responsible for security of OFCI materials until Beneficial Occupancy. DISTRICT REPRESENTATIVE will sign receipt or bill of lading as applicable.

C. CONTRACTOR shall, within ten days after delivery, uncrate and/or unpack OFCI materials in presence of OWNER who shall inspect delivered items. OWNER shall prepare an inspection report listing damaged or missing parts and accessories. OWNER shall transmit one copy of the report to CONTRACTOR. OWNER will procure and/or replace missing and or damaged OFCI materials, as indicated in inspection report.

D. CONTRACTOR shall install OFCI materials in the locations and orientation as indicated in the Contract Documents. CONTRACTOR shall verify exact locations with DISTRICT REPRESENTATIVE before final installation of OFCI materials.

E. If required, DISTRICT REPRESENTATIVE will furnish setting and or placement drawings for OFCI materials.

F. CONTRACTOR shall install OFCI materials by proper means and methods to ensure an installation as recommended by the manufacturer. CONTRACTOR shall furnish and install all necessary fasteners and required blocking to properly install OFCI materials.

G. CONTRACTOR shall install OFCI materials with manufacturer recommended fasteners for the type of construction to which the OFCI materials are being fastened and/or anchored.

H. CONTRACTOR shall provide final connections of any electrical, signal, gas, water, waste, venting and/or similar items to OFCI materials. CONTRACTOR shall, prior to final connection, verify the operating characteristics of OFCI materials are consistent with the designated supply.

1.07 CONTACTOR FURNISHED OWNER INSTALLED (CFOI) MATERIALS

A. Certain materials are identified in the Contract Documents as CONTRACTOR Furnished OWNER Installed (CFOI). CFOI materials shall be delivered to OWNER by CONTRACTOR. CONTRACTOR shall furnish the following per the contract documents:

a. Key cores - Contractor to have the supplier send zero bitted cores with specified keyway and key blanks directly to District locksmith. Materials must be received directly from the manufacturer six months prior to occupancy.

PART 2 – PRODUCTS (Not applicable)

PART 3 – EXECUTION (Not applicable)

END OF SECTION 01 11 00

SECTION 01 12 16 – PHASING OF THE WORK

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Requirements for phasing of the Work include logistics, phasing, and completion of designated phases prior to commencement of subsequent phases.

1.02 RELATED SECTIONS

A. Section 01 11 00: Summary of Work.

B. Section 01 31 13: Project Coordination.

1.03 SUBMITTALS

A. CONTRACTOR shall submit a Project site logistics plans in accordance with and as required by this Section.

PART 2 – PRODUCTS (Not applicable)

PART 3 – EXECUTION

3.01 LOGISTICS

A. Prior to commencement of the Work, CONTRACTOR shall prepare and submit to the DISTRICT REPRESENTATIVE, a detailed Project site logistic plan, in the same size and scale of the Drawings, setting forth CONTRACTOR plan of the Work relative to the following, but not limited to, items:

1. In accordance with local ordinances a truck access route to and from the Project site.
2. The identification of any overhead wire restrictions for power, street lighting, signal, and/or cable.
3. Local sidewalk access and street closure requirements.
4. Protection of sidewalk pedestrians and vehicular traffic.
5. Project site fencing and access gate locations.
6. Construction parking.
7. Material staging and/or delivery areas.
8. Material storage areas.
9. Temporary trailer locations.
10. Temporary service location and proposed routing of all temporary utilities.
11. Location of temporary and/or accessible fire protection
12. Trash removal and location of dumpsters.
13. Concrete pumping locations.
14. Crane locations.
15. Location of portable sanitary facilities.
16. Mixer truck wash out locations.
17. Traffic control signage.

18. Perimeter and site lighting.
19. Stockpile and/or lay down areas.
20. Emergency Vehicle Access Routes.

B. A revised Project site logistic plan may be required by the DISTRICT REPRESENTATIVE for separately identified phases of the Work as set forth in this Section.

C. CONTRACTOR is responsible for securing and/or obtaining all approvals and permits from authorities having jurisdiction relative to logistic plan activities.

3.03 PHASING OF THE WORK

A. Project will be constructed in separate Milestone increments, as identified or as described in this Section and/or the Contract Documents. Phasing will also delineate Work to be completed in each designated phase. Unless otherwise approved or directed by the DISTRICT REPRESENTATIVE, each phase shall be completed according to the approved Construction Schedule prior to the commencement of the next subsequent phase. CONTRACTOR shall incorporate and coordinate the Work of Separate Work Contracts relative to this Project into the Phasing and Construction Schedule.

B. CONTRACTOR shall install all necessary Work for phased Work before completion of the designated phase.

3.04 PHASING OF THE WORK – GENERAL

A. CONTRACTOR shall prepare the Milestone Schedule in order to complete the Work and related activities in accordance with the phasing plan. CONTRACTOR shall include all costs to complete all Work within the Milestones and/or Contract Time.

B. OWNER will be seriously damaged by not having all Work completed within the Milestones and/or Contract Time. It is mandatory the Work be complete within the Milestones and/or Contract Time.

3.05 PHASING OF THE WORK – SPECIFIC

A. CONTRACTOR shall prepare Construction Schedule, and shall complete the following Milestones, but not limited to, within the designated phases in accordance with the following:

1. Phase 1 Mobilization – **(14)** calendar days
2. Phase 2 Construction – **(275)** calendar days
3. Phase 3 Administrative Closeout – **(90)** calendar days

END OF SECTION 01 12 16

SECTION 01 26 00 – CONTRACT MODIFICATION PROCEDURES

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. This section specifies administrative and procedural requirements for handling and processing Contract Modifications.

B. The General Conditions and Division 1 are part of this Section and the Contract for this Work and apply to this Section as if repeated fully herein.

1.02 RELATED SECTIONS

A. Section 01 11 00: Summary of the Work.

B. Section 01 31 13: Project Coordination.

C. Section 01 32 29: Project Forms.

1.03 REQUEST FOR PROPOSAL ("RFP")

A. An RFP is a written request that will require an adjustment to the Contract Sum or Time or both, if accepted by the Owner. The RFP will be issued by the Architect at the request of the District Representative with a detailed description of the proposed change and supplemental or revised Drawings and Specifications. RFP's are for information only and shall not be considered as instruction to stop the Work or to execute the change.

1.04 CHANGE ORDER PROPOSAL ("COP")

A. A COP is the written detailed document in response to the Architect's RFP. The Contractor will respond with all documents required by District Representative, and Contract Documents to analyze proposal and make recommendations to Owner. The Contractor will submit, but not limited to the following:

1. Unless otherwise indicated, within **ten (10)** days of receipt, submit an estimate of cost to execute the change.

    a. Include a list of quantities of products to be purchased and unit costs, along with amount of purchase to be made. If requested, furnish survey data to substantiate quantities.

    b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.

    c. Follow Owner requirements as outlined in the General Conditions regarding allowable overhead and profit.

    d. Include a statement indicating the effect the proposed change in the Work will have on the Contract time.

1.05 CHANGE ORDER REQUEST ("COR")

A. When unforeseen conditions require modification to the Contract, the Contractor may propose changes by submitting a COR to the District Representative and Architect for review and/or action.

B. The Contractor will submit the following as part of the COR:

1. Include a statement outlining reasons for the change. Provide a complete description of the change. Indicate effect on the proposed change on the Contract Sum and Time.
2. Include a list of quantities of products to be purchased and unit costs, along with amount of purchases to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Follow OWNER requirements as outlined in the General Conditions regarding allowable overhead and profit.
5. Comply with requirements in Section “Substitutions” if the change requires substitution of one product or system for product or system specified.
6. COR’S are for information only and shall not be considered a reason to stop the Work, unless instructed to do so in writing by District Representative and/or Architect.

1.06 CONSTRUCTION CHANGE DIRECTIVE (“CCD”)

A. The District Representative may issue a CCD instructing the Contractor to proceed with a change, for subsequent inclusion in a Change Order.

B. Contractor may issue a time and material change or a lump sum change, which shall be at the discretion of the Owner.

C. Maintain detailed records on a time and material basis of work required by the CCD. Refer to Section 01 32 29 for a sample daily time and material record sheet.

1. Contractor must notify the District Representative of time and materials work prior to start and immediately after finishing the work on a daily basis.
2. After completion of the change submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

D. When the Owner and Contractor are not in agreement on terms of a Change Order, the District Representative may issue a CCD on the behalf of the Owner instructing the Contractor to proceed with a change.

1. The Contractor will keep a complete and separate record of all labor, equipment, materials, and supplies regarding the change when a disagreement exists.
2. A disagreement between the Owner and the Contractor concerning a CCD shall not be considered a reason to stop Work by the Contractor.

1.07 CHANGE ORDER (“CO”)

A. Upon the OWNER’S approval of a Change Order Proposal, the District Representative will prepare a Change Order for signature of the Owner, Architect, and the Contractor.

PART 2 – PRODUCTS (Not applicable)

PART 3 – EXECUTION

3.01 PROCEDURE

A. NO design alterations to the contract documents by District Representative or Contractor shall be initiated or permitted unless reviewed and approved by the Architect and/or Owner.

B. Changes or alterations to the approved drawings or specifications shall be made by means of addenda or change orders as per section 4-338 of the California Building Standards Administrative Code.

END OF SECTION 01 26 00

SECTION 01 31 13 – PROJECT COORDINATION

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. This Section specifies administrative and procedural requirements necessary for coordinating Work operations including, but not limited to, the following:

1. General coordination procedures.
2. Coordination drawings.

1.02. RELATED SECTIONS

A. Section 01 12 16: Phasing of the Work.

D. Section 01 45 23: Testing and Inspection.

PART 2 – PRODUCTS (Not used)

PART 3 – EXECUTION

3.01 COORDINATION

A. It is the CONTRACTOR'S responsibility to coordinate the Work so as to minimize conflicts and optimize efficiency.

B. The placement of pipes, conduits, other materials, and the locations, size and reinforcement of holes in the building structure shall conform to the structural Drawing and Specifications. When the requirements of the Mechanical, Electrical or other sections of the Specifications or Drawings are in conflict with the structural requirements, the structural requirements shall take precedence. Where the safety of the building structure is threatened, due to mechanical, electrical, or other construction of holes required for such construction, modifications shall be made as directed by the ARCHITECT at no additional cost to the District.

C. Verify that utility, and other building system requirement characteristics of operating equipment are compatible with existing utilities, and other existing building systems. Coordinate work of various Sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

D. CONTRACTOR shall coordinate operations included in various sections of Contract Documents to assure efficient and orderly installation of each part of Work. Coordinate Work operations included under related sections of Contract Documents that depend on each other for proper installation, connection, and operation of Work, including but not limited to:

1. Schedule construction operations in sequence required where installation of one part of Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to assure maximum accessibility for required maintenance, service, and repair.
3. Provide provisions to accommodate items scheduled for later installation.
4. Prepare and administer provisions for coordination drawings.

E. Where necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required in notices, reports, attendance at meetings, and:

1. Prepare similar memoranda for DISTRICT REPRESENTATIVE and Separate Work Contract where coordination of their Work is required.

F. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and assure orderly progress of Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of schedules.
2. Installation, relocation, and removal of temporary facilities.
3. Delivery and processing of submittals.
4. Progress meetings.
5. Project closeout activities.

G. Conservation: Coordinate Work operations to assure operations are carried out with consideration given to conservation of energy, water, materials, and:

1. Salvage materials and equipment involved in performance of, but not actually incorporated into Work.

3.02 SUBMITTALS

A. Coordination Drawings: CONTRACTOR shall prepare coordination drawings to coordinate the installation of products and materials fabricated, furnished and installed by separate entities, under different parts of the Contract. CONTRACTOR shall notify DISTRICT REPRESENTATIVE and ARCHITECT of all major conflicts in writing in a timely manner so that the design team can respond without construction delays. Coordination drawings shall address the following at a minimum:

1. Limitations in available space for installation or service. CONTRACTOR shall overlay plans of each trade and verify space requirements and conflicts between trades. Minor changes and adjustments that do not affect design intent shall be made by CONTRACTOR and shall be highlighted for ARCHITECT'S review.

2. Incompatibility between items provided under different trades (such as difference in voltage between equipment specified under Divisions 22 and 23 and electrical power provided under Division 26.)

3. Inconsistencies between drawings, specifications and codes (between trades and within each trade).

4. Additional items required for existing facilities construction projects shall be designed and prepared from available as-built drawings that are verified through non-invasive and non-destructive, visual observation only. CONTRACTOR shall field verify actual existing conditions during and upon completion of demolition work and incorporate findings into preparation of coordination drawings. Minor changes and adjustments that do not affect design intent shall be made by Contractor and shall be highlighted for DISTRICT REPRESENTATIVE and ARCHITECT'S reviews.

B. Prepare coordination drawings in AutoCAD with each trade on a separate layer, in specified color and scale. CONTRACTOR and each Subcontractor shall provide and forward reproducible copies and AutoCAD drawing files in the order described here:

1. Structural shop drawings shall indicate location and sizes of columns, beams and other structural members, as well as wall, roof and slab penetrations, and will be provided to mechanical, electrical, low voltage and plumbing Sub-contractors for coordination. Structural items shall be indicated using black lines.

2. HVAC Subcontractor will indicate all ductwork, piping and equipment complete with installation and dimensioned service clearances, duct and pipe sizes, fitting types and sizes, top or bottom of duct and pipe elevations, distances of ducts, pipes and equipment from building reference points and hanger and support locations. Minor changes and adjustments that do not affect design intent shall be made by Subcontractor and shall be highlighted for DISTRICT REPRESENTATIVE and ARCHITECT'S reviews. Forward drawings to plumbing Subcontractor for further coordination. HVAC items shall be indicated using orange lines.

3. Plumbing Subcontractor will indicate all plumbing lines, and equipment complete with installation and dimensioned service clearances, pipe sizes, fitting types and sizes, top or bottom of pipe elevations, distances of pipes and equipment from building reference points and hanger/support locations Coordinate with HVAC Subcontractor. Minor changes and adjustments that do not affect design intent shall be made by Sub-contractor and shall be highlighted for DISTRICT REPRESENTATIVE and ARCHITECT'S reviews Upon completion drawings shall be forwarded to Fire Sprinkler Subcontractor for further coordination. All Plumbing items shall be indicated using blue lines.

4. Electrical and Low Voltage Subcontractors will indicate service and feeder conduit runs and other electrical equipment complete, including low voltage with installation and dimensioned service clearances, sizes, top or bottom of conduit and rack elevations, distances of conduits and equipment from building reference points and hanger and support locations. Coordinate with Fire Sprinkler, Plumbing and HVAC Subcontractors. Minor changes and adjustments that do not affect design intent shall be made by sub-contractors and shall be highlighted for DISTRICT REPRESENTATIVE and ARCHITECT'S reviews. Upon completion drawings shall be forwarded to CONTRACTOR for further coordination. Electrical work shall be indicated in dark green lines. Low voltage work shall be indicated in light green lines.

5. CONTRACTOR will be responsible for the overall coordination review. As each coordination drawing is completed, CONTRACTOR will meet with DISTRICT REPRESENTATIVE to review and resolve all conflicts on coordination drawings.

6. Coordination meetings will be held in Project field office of CONTRACTOR. CONTRACTOR is required to distribute Shop Drawings, cut sheets and submittals to Subcontractors where appropriate. Reviewed coordination drawings will be maintained in Project field office of CONTRACTOR. Meeting minutes shall be developed by CONTRACTOR and submitted to DISTRICT REPRESENTATIVE within **five (5)** days.

END OF SECTION 01 31 13

SECTION 01 31 19 - PROJECT MEETINGS

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. This Section specifies administrative and procedural requirements for Project meetings, including but not limited to, the following:

1. Preconstruction meeting.
2. Pre-installation conferences.
3. Progress meetings.
4. Meetings as required by DISTRICT REPRESENTATIVE.

PART 2 – PRODUCTS (Not used)

PART 3 – EXECUTION

3.01 PRECONSTRUCTION MEETING

A. DISTRICT REPRESENTATIVE will schedule a preconstruction meeting before starting the Work, at a time and date determined by DISTRICT REPRESENTATIVE. Meeting shall be held at the Project site or another location as determined by DISTRICT REPRESENTATIVE. Meeting will be held in order to review responsibilities, procedures, and other administrative requirements contained within the Contract Documents.

B. Authorized representatives of OWNER, INSPECTOR, ARCHITECT, CONTRACTOR and other parties shall attend the meeting. All participants at the meeting shall be familiar with the Project and authorized to conclude matters relating to the Work.

C. Agenda items shall include significant items which could affect progress of the Work, including, but not limited to the following:

1. Identification of DISTRICT REPRESENTATIVE.
2. Preliminary Construction Schedule.
3. Critical work sequencing.
4. Designation of responsible personnel.
5. Procedures for processing field decisions.
6. Request for Proposal.
7. Request for Information.
8. Construction Change Directive, Immediate Change Directive, and Change Order.
9. Procedures for processing Applications for Payment.
10. Labor Compliance and Wage Determinations.
11. Submittal and review of Shop Drawings, Product Data, material lists, and Samples.
12. Preparation of project record documents.
13. Use of the Project site and/or premises.

14. Parking availability.
15. Office, work, and storage areas.
16. Equipment deliveries and priorities.
17. Safety procedures.
18. First Aid.
19. Security.
20. Housekeeping.
21. Working hours.
22. Insurance Services including OCIP.
23. Environmental Health and Safety / Import and Export Testing Requirements.
24. Beneficial Occupancy, Administrative Closeout and Contract Completion requirements and procedures.
25. Storm Water Pollution Prevention Plan (SWPPP).
26. CEQA Compliance.

D. DISTRICT REPRESENTATIVE shall prepare and issue meeting minutes to attendees and interested parties no later than three (3) calendar days after the meeting date.

3.02 PRE-INSTALLATION CONFERENCES

A. CONTRACTOR shall coordinate and conduct pre-installation conferences at the Project site as required by related Sections of the Contract Documents.

B. CONTRACTOR, manufacturers, and fabricators involved in or affected by the installation and its coordination or integration with other preceding and/or subsequent installations of Work shall attend the meeting. CONTRACTOR shall advise DISTRICT REPRESENTATIVE, INSPECTOR, and ARCHITECT of scheduled meeting dates.

1. CONTRACTOR shall review the progress of construction activities and preparations for the particular activity under consideration at each pre-installation conference, including requirements for the following:
    a. Contract Documents.
    b. Options.
    c. Related Construction Change Directives and Change Orders.
    d. Purchases.
    e. Deliveries.
    f. Shop Drawings, Product Data, and quality-control samples.
    g. Review of mockups.
    h. Possible conflicts.
    i. Compatibility problems.
    j. Time schedules.
    k. Weather limitations.
    l. Manufacturer’s recommendations.
    m. Warranty requirements.

n. Compatibility of materials.

o. Acceptability of substrates.

p. Temporary facilities.

q. Space and access limitations.

r. Governing regulations.

s. Safety.

t. Inspecting and testing requirements.

u. Required performance results.

v. Recording requirements.

w. Protection.

2. CONTRACTOR shall record significant discussions and directives received from each conference. CONTRACTOR shall, within three (3) calendar days after the meeting date, distribute the minutes of the meeting to all concerned parties, including but not limited to, DISTRICT REPRESENTATIVE, INSPECTOR, and ARCHITECT.

3.03 PROGRESS MEETINGS

A. Progress meetings will be held at the Project site at regular intervals, typically weekly, as determined by the DISTRICT REPRESENTATIVE.

B. In addition to representatives of CONTRACTOR, OWNER, and ARCHITECT, each Subcontractor, supplier, or other entity concerned with current progress or involved in planning, coordination, or performance of the Work shall, if requested by DISTRICT REPRESENTATIVE, be represented at these meetings. All participants at the meeting shall be familiar with the Project and authorized to conclude all matters relating to the Work.

C. Failure of CONTRACTOR to be so represented at any progress meeting which is held at a mutually agreed time or for which a written notice is given, shall not relieve CONTRACTOR from abiding by any and all DISTRICT REPRESENTATIVE determinations or directives issued at such meeting.

D. DISTRICT REPRESENTATIVE will review and correct or approve minutes of the previous progress meeting and will review other significant items affecting progress. Topics for discussion as appropriate to the status of the Project include but are not limited to:

1. Interface requirements.

2. Construction Schedule.

3. Sequence and coordination.

4. Status of submittals / RFIs.

5. Deliveries.

6. Off-site fabrication.

7. Access.

8. Site utilization.

9. Temporary Construction Facilities and Controls.

10. Hours of work.

11. Hazards and risks.
12. Housekeeping.
13. Quality of materials, fabrication, and execution.
14. Unforeseen conditions.
15. Testing and Inspection.
16. Defective Work.
17. Construction Change Directive.
18. Request for Proposal.
19. Change Order Proposals and Change Orders.
20. Documentation of information for payment requests.
21. Application for Payment.
22. Other items as required or as brought forth.
23. Initial Notice of Start of Issue, Event, Condition, Circumstance, or Cause of Perceived Delay, Disruption, Interference, Hindrance, Acceleration.
24. Final Notice of End of Issue, Event, Condition, Circumstance, or Cause of Perceived Delay, Disruption, Interference, Hindrance, Acceleration (General Conditions).
25. Storm Water Pollution Prevention.
26. CEQA Compliance.

E. No later than three (3) calendar days after each progress meeting, DISTRICT REPRESENTATIVE will prepare and distribute minutes of the meeting to each present and absent party. Include a brief summary, in narrative form, of progress, decisions, directives, actions taken, and all other issues since the previous meeting and report.

1. Schedule Updating: CONTRACTOR shall revise the Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized, and issue the revised schedule at the next scheduled progress meeting.

3.04 ADDITIONAL MEETINGS

A. DISTRICT REPRESENTATIVE, upon giving notice to the intended parties and without further obligation, may require additional meetings to discuss Work and/or Project related activities.

3.05 OWNER'S RIGHT TO RECORD

A. CONTRACTOR agrees on behalf of itself and all its subcontractors that the OWNER may audiotape or videotape any meetings, training, and any work at any time during the Project.

END OF SECTION 01 31 19

SECTION 01 32 29 - PROJECT FORMS

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. The following, but not limited to, District administrative forms and documents listed in this Section to be utilized in the administration of the Work.

B. From time to time, Owner may release new revisions and new Project Forms. At any time during the Project, if requested by District Representative, Contractor shall use the newly released Project Forms.

1.02 RELATED DOCUMENTS

A. General Conditions.

B. Division 01.

PART 2 – PRODUCTS (Not applicable)

PART 3 – EXECUTION

3.01 FORMS

CONTRACTOR to utilize the following District forms:

1. Application for Payment
2. Change Order Justification
3. Request for Import Materials Testing
4. Request for Export Materials Testing
5. Unconditional Waiver and Release – Progress Payment
6. Construction Waste Management Plan
7. Inspection Request
8. Time and Material Diary
9. After Hours Work Notification
10. Daily Job Report
11. Key Request
12. Dig Alert Location Request
13. Notification for Utilities Shutdown
14. Request for Information
15. Skilled and Trained Workforce Compliance Report
16. Notice of Criminal Record Checks

3.02 PROCEDURES

A. Application for Payment: This form is used in requesting a progress payment.

B. Change Order Justification: This form is used to adjust the Contract Amount, Milestones and/or the Contract Time.

C. Request for Import Materials Testing: This form is used to request import material testing from a District pre-tested or non-pre-test site.

D. Request for Export Materials Testing: This form is used to request export material testing prior to exporting material to an off-site location.

H. Unconditional Waiver and Release – Progress Payment: Use this form when the claimant is required to execute a waiver and release in exchange for or in order to induce payment of a progress payment and the claimant asserts in the waiver that he or she has in fact been paid the progress payment.

I. Construction Waste Management Plan: This form is used to provide a Waste Management Plan within **ten (10)** calendar days after the Notice to Proceed and prior to any waste removal.

K. Inspection Request: This form is used to request an inspection.

END OF SECTION 01 32 29

SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Administrative and procedural requirements for submittals required for the Work, including but not limited to; Shop Drawings, Product Data, Samples, material lists, and quality control items as required by the Contract Documents.

B. Wherever possible, throughout the Contract Documents, the minimum acceptable quality of workmanship and products has been defined by the name and catalog number of a manufacturer and by reference of recognized industry standards.

C. To ensure that specified products are furnished and installed in accordance with the design intent, Facility Design Standards and procedures have been established for submittal of design data and for its review by DISTRICT REPRESENTATIVE, ARCHITECT, and/or others.

1.02 RELATED SECTIONS

A. General Conditions.

B. Section 01 12 16: Phasing of the Work.

C. Section 01 29 73: Schedule of Values Procedures.

D. Section 01 29 76: Progress Payment Procedures.

E. Section 01 31 13: Project Coordination.

F. Section 01 32 13: Construction Schedule.

G. Section 01 45 23: Testing and Inspection.

H. Section 01 50 00: Construction Facilities and Temporary Controls.

I. Division 2 through Division 32.

PART 2 – PRODUCTS (Not applicable)

PART 3 – EXECUTION

3.01 GENERAL REQUIREMENT AND PROCEDURES

A. CONTRACTOR shall package each submittal appropriately for transmittal and handling and will then send ARCHITECT, and DISTRICT REPRESENTATIVE submittal for review per the Project plans and specifications. Submittals will not be accepted from sources other than from CONTRACTOR.

B. CONTRACTOR shall clearly identify any deviations from the Contract Documents on each submittal. Any deviation not so noted, even if stamped reviewed, is not acceptable.

C. After ARCHITECT review, ARCHITECT shall transmit submittals to CONTRACTOR and DISTRICT REPRESENTATIVE and PROJECT INSPECTOR. CONTRACTOR shall further distribute to SUBCONTRACTORS and others as required. Work shall not commence, unless otherwise approved by DISTRICT REPRESENTATIVE, and/or ARCHITECT until approved submittals are transmitted to CONTRACTOR.

D. CONTRACTOR'S Review and Approval: Every submittal upon which proper execution of the Work is dependent shall bear the CONTRACTORS review and approval stamp, dated and signed by CONTRACTOR. Certifying that CONTRACTOR (a) has reviewed, checked, and approved the submittal and has coordinated the submittal contents with requirements of Work and Contract Documents including related Work, (b) CONTRACTOR coordinated with all other shop drawings received to date and this duty of coordination has not been delegated to subcontractors, material suppliers, the Architect, or the engineers on this

project, (c) determined and verified quantities, field measurements, construction criteria, materials, equipment, catalog numbers and identifications, and similar data, or will do so, and (d) states the Work illustrated or described in the submittal is recommended by CONTRACTOR and the CONTRACTORS warranty will fully apply thereto.

E. CONTRACTOR shall coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities requiring sequential activity.

F. Timing of Submittals:

1. In accordance with General Conditions, CONTRACTOR shall submit to the ARCHITECT, those Shop Drawings, Product Data, diagrams, materials lists, Samples and other submittals required by the Contract Documents.

2. The CONTRACTOR shall submit within five (5) calendar days of the Notice to Proceed, an itemized listing of required submittals with a scheduled date for each submittal. The schedule of submittals shall provide adequate time between submittals in order to allow for proper review without negative impact to the Construction Schedule.

3. Schedule of submittals shall be related to Work progress, and shall be so organized as to allow sufficient time for transmitting, reviewing, corrections, resubmission, and re-reviewing.

4. CONTRACTOR shall coordinate submittal of related items and ARCHITECT reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received by ARCHITECT.

5. CONTRACTOR shall revise, update and submit submittal schedule to DISTRICT REPRESENTATIVE and ARCHITECT on the first of each month, or as required by the DISTRICT REPRESENTATIVE.

6. CONTRACTOR shall allow in the Construction Schedule, at least **fourteen (14)** calendar days for ARCHITECT review following ARCHITECT receipt of submittal. For mechanical, plumbing, electrical, structural, and other submittals requiring joint review with ARCHITECT'S Consultants, and/or others, CONTRACTOR shall allow a minimum of **ten (10)** calendar days following ARCHITECT receipt of submittal. Submittals will be reviewed with reasonable promptness, but ARCHITECT reserves the right of additional time where required based on but limited to submittal size, complexity, etc.

7. No adjustments to the Contract Time and/or Milestones will be authorized because of a failure to transmit submittals to ARCHITECT sufficiently in advance of the Work to permit review and processing.

8. In case of product substitution, Shop Drawing preparation shall not commence until such time ARCHITECT and DISTRICT REPRESENTATIVE reviews said submittal relative to the General Conditions.

G. If required, resubmit submittals in a timely manner. Resubmit as specified for initial submittal but identify as such. Review times for re-submitted items shall be as per the time frames for initial submittal review.

H. ARCHITECT, or authorized agent, will stamp each submittal with a uniform, action stamp. ARCHITECT, or authorized agent, will mark the stamp appropriately to indicate the action taken, as follows:

1. Final Unrestricted Release: When ARCHITECT, or authorized agent, marks a submittal "Reviewed" the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents. Final payment depends on that compliance.

2. Final-But-Restricted Release: When ARCHITECT, or authorized agent, marks a submittal “Reviewed as Noted” the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents. Final payment depends on that compliance.

3. Returned for Re-submittal: When ARCHITECT, or authorized agent, marks a submittal “Rejected, Revise and Resubmit” do not proceed with Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal according to the notations; resubmit without delay. Repeat as necessary to obtain different action mark. In case of multiple submittals covering same items of Work, CONTRACTOR is responsible for any time delays, schedule disruptions, out of sequence Work, or additional costs due to multiple submissions of the same submittal item. Do not use, or allow others to use, submittals marked “Rejected, Revise and Resubmit” at the Project site or elsewhere where Work is in progress.

4. Other Action: Where a submittal is for information or record purposes or special processing or other activity, the ARCHITECT, or authorized agent, will return the submittal marked “Action Not Required”.

I. Review and Approval of Submittals by the ARCHITECT: Submittals will be reviewed but only for conformance with the design concept of the Project and with the information indicated on the Drawings and stated in the Specifications. Approval of a separate item as such will not indicate approval of the assembly in which the item functions. Approval of submittals shall not relieve the CONTRACTOR of responsibility for any deviations from requirements of the Contract Documents or any revisions in resubmittals unless CONTRACTOR has given written notice of such deviation or revision at the time of submission or resubmission and written approval has been given to the specific deviation or revision, nor shall approval relieve the CONTRACTOR of responsibility for error or omissions in the submittals or for the accuracy of dimensions and quantities, the adequacy of connections, and the proper and acceptable fitting, execution, functioning, and completion to the Work.

J. All costs for the preparation, correction, delivery, and return of the submittals shall be borne by the CONTRACTOR.

3.02 SHOP DRAWINGS

A. Shop Drawings are original drawings prepared by CONTRACTOR, Subcontractor, supplier, or distributor illustrating some portion of Work by showing fabrication, layout, setting, or erection details. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. ***Copies of the Contract Drawing marked to show Shop Drawing information are not acceptable and will be not be reviewed and will be promptly returned to the CONTRACTOR.***

B. Produce Shop Drawings to an accurate scale that is large enough to indicate all pertinent features and methods. Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 x 11 inches but no larger than 30 x 42 inches.

C. Shop Drawings shall include, at a minimum, fabrication and installation drawings, setting diagrams, schedules, patterns, templates, and similar drawings. Include the following information:

1. Dimensions

2. Identification of products and materials included by sheet and detail number.

3. Compliance with specified standards.

4. Notation of coordination requirements.

5. Notation of dimensions established by field measurement.

D. Provide two (2) spaces, approximately 4 by 5 inches, on the label or beside the title block on Shop Drawings to record CONTRACTOR and ARCHITECT review, and the action taken. Include the following information on the label for processing and recording action taken:

1. Project name.
2. Project number.
3. Date.
4. Name and address of ARCHITECT.
5. Name and address of CONTRACTOR.
6. Name and address of Subcontractor.
7. Name and address of supplier.
8. Name and address of manufacturer.
9. Name and title of appropriate Specification section.
10. Drawing number and detail references, as appropriate.

E. Submit a sufficient number to allow for adequate CONTRACTOR, Subcontractor, supplier, manufacturer and fabricators distribution plus two (2) sets to be retained by ARCHITECT, one (1) set to PROJECT INSPECTOR, and one (1) set for the OWNER. For all Low Voltage submittals, provide (2) sets for the OWNER.

3.03 PRODUCT DATA

A. Collect Product Data into a single submittal for each element of Work or system. Product Data includes printed information, such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, wiring diagrams, schedules, illustrations, or performance curves.

1. Mark each copy to show or delineate pertinent materials, products, models, applicable choices, or options. Where Product Data includes information on several products that are not required, clearly mark copies to indicate the applicable information. Include the following information:
    a. Manufacturer's printed recommendations.
    b. Compliance with trade association standards.
    c. Compliance with recognized testing agency standards.
    d. Application of testing agency labels and seals.
    e. Notation of dimensions verified by field measurement.
    f. Notation of coordination requirements.
    g. Notation of dimensions and required clearances.
    h. Indicate performance characteristics and capacities.
    i. Indicate wiring diagrams and controls.
2. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.

C. Required Copies and Distribution: Same as denoted in Section 3.02, E.

3.04 SAMPLES

A. Submit Samples of sufficient size, quantity, cured and finished and physically identical to the proposed product or material. Samples include partial or full sections or range of

manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches denoting color, texture, and/or pattern.

1. Mount or display Samples in the manner to facilitate review of qualities indicated. Include the following:
    a. Specification section number and reference.
    b. Generic description of the Sample.
    c. Sampling source.
    d. Product name or name of manufacturer.
    e. Compliance with recognized standards.
    f. Availability and delivery time.
2. Submit Samples for review of size, kind, color, pattern, and texture. Submit Samples for a final check of these characteristics with other elements and a comparison of these characteristics between the final submittal and the actual component as delivered and installed.
    a. Where variations in color, pattern, texture, or other characteristic is inherent in the material or product represented, submit at least three (3) multiple units that show the approximate limits of the variations.
    b. Refer to other Specification sections for requirements for Samples that illustrate workmanship, fabrication techniques, assembly details, connections, operation, and similar construction characteristics.
    c. Refer to other sections for Samples to be returned to CONTRACTOR for incorporation into the Work. Such Samples must be undamaged at time of installation. On the transmittal indicate special requests regarding disposition of Sample submittals.
    d. Samples not incorporated into the Work, or otherwise not designated as OWNER property, remain the property of CONTRACTOR and shall be removed from the Project site prior to Beneficial Occupancy.
3. Color and Pattern: Whenever a choice of color or pattern is available in a specified product, submit accurate color chips and pattern charts to ARCHITECT for review and selection by ARCHITECT and OWNER.
4. Required Copies and Distribution: Same as denoted in Section 3.02, E.

B. When specified, erect field Samples and mock-ups at the Project site to illustrate products, materials, or workmanship and to establish standards by which completed Work shall be judged.

C. Maintain sets of Samples, as returned, at the Project site, for quality comparisons throughout the course of the Work. Sample sets may be used to obtain final acceptance of the Work associated with each set.

3.05 QUALITY CONTROL SUBMITTALS

A. Submit quality control submittals, including design data, certifications, manufacturer's field reports, and other quality control submittals as required under other sections of the Contract Documents.

B. When other sections of the Contract Documents require manufacturer's certification of a product, material, and/or installation complies with specified requirements, submit a notarized certification from the manufacturer certifying compliance with specified requirements.

C. Certification shall be signed by an officer of the manufacturer or other individual authorized to sign documents on behalf of the represented company.

D. Requirements for submittal of inspection and test reports are specified in other sections of the Contract Documents.

3.06 CERTIFICATES

A. Submit all certificates in triplicate to PROJECT INSPECTOR, in accordance with requirements of each Specification Section.

END OF SECTION 01 33 00

SECTION 01 45 23 – TESTING AND INSPECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Testing and inspection services to meet requirements of the California Building Code (CBC).

B. Tests of materials are required by a DSA certified Testing Agency as set forth in Section 4-335 of the California Building Standards Commission's, California Administrative Code.

C. Appendix A: DSA Form 103, Structural Testing & Inspections

1.02 RELATED SECTIONS

A. General Conditions.

B. Section 01 31 13: Project Coordination.

1.03 COORDINATION OF TESTS AND INSPECTIONS

A. Contractor shall establish a protocol for requesting inspections and special inspections so as to not delay the progress of the work. Contractor shall review General Conditions for additional requirements.

1.04 TESTING COSTS

A. Owner will pay special inspections and testing identified in the Statement of Structural Tests and Special Inspections (DSA FORM 103) except Contractor shall reimburse the Owner for retesting costs caused by failure of materials to pass initial tests. Contractor shall arrange and pay for all other testing that are specified in other specification sections.

1. Reimbursement of Inspection Costs: The Contractor shall reimburse to the Owner all or any part, as the Owner may deem just and proper, of the actual excessive inspection costs incurred by the Owner due to any or all of the following:

   i. Contractor's failure to complete the Work within the Contract Time stated in the Agreement, and any previously authorized extensions thereof.

   ii. Claims between separate contractors

   iii. Covering of any of the Work before the required inspections of tests are performed.

   iv. Extra inspections required for Contractor's correction of defective Work.

   v. Overtime costs for acceleration of Work done for Contractor's convenience.

1.05 CONTRACTOR-FURNISHED ASSISTANCE

A. When requested, Contractor shall furnish access, facilities, and labor assistance as necessary for duties to be performed at the site by Test Laboratory, and Inspector, including ladders, hoisting, temporary lighting, water, and like services.

PART 2 – PRODUCTS (Not used)

PART 3 – EXECUTION

3.01 SCHEDULES FOR TESTING

A. Establishing Schedule:

1. By advance discussion with the testing laboratory selected by the Owner, determine the time required for the laboratory to perform its tests and to issue each of its findings.

2. Provide required time within the construction schedule.

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

C. Adherence to Schedule: When the testing laboratory is ready to test according to the determined schedules, but is prevented from testing or taking specimens due to incompleteness of the work, extra charges for testing attributable to the delay may be back-charged to the Contractor and may be deducted by the Owner from the contract sum.

3.02 TESTS

A. Owner will select and provide an independent DSA certified testing agency (Testing Agency) to conduct tests, sampling, and testing of materials. Selection of material to be tested shall be by the Testing Agency and not by Contractor.

B. The Contractor shall not incorporate into the work any material shipped from the source of supply prior to having satisfactorily passed the required testing and inspection, or prior to the receipt of notice from Project Inspector that the testing and inspection is not required.

C. Owner will select, and directly reimburse, the Testing Agency for costs of all DSA required tests and inspections; however, the Owner may be reimbursed by Contractor for such costs as specified or noted in related sections of the Contract Documents.

D. The independent Testing Agency is not authorized to release, revoke, alter, or enlarge requirements of the Contract Documents or approve or accept any portion of the Work.

E. The Testing Agency shall not perform any duties of Contractor.

F. Contractor shall provide an insulated curing box with the capacity for twenty (20) concrete cylinders and will relocate said box and cylinders as rapidly as required in order to provide for progress of the Work.

3.02 TEST REPORTS

A. Test reports shall include all tests performed, regardless of whether such tests indicate the material is satisfactory or unsatisfactory. Samples taken but not tested shall also be reported. Records of special sampling operations, when and as required, shall also be reported. Reports shall indicate the material (or materials) was sampled and tested in accordance with requirements of CBC, Title 24, Parts 1 and 2, as indicated on the Drawings. Test reports shall indicate specified design strength and specifically state whether or not the material (or materials) tested comply with the specified requirements.

3.03 VERIFICATION OF TEST REPORTS

A. Each Testing Agency shall submit to the Division of the State Architect, in duplicate, a verified report covering all tests required to be performed by that Testing Agency during the progress of the Work. Such report, covering all required tests, shall be furnished in accordance with DSA requirements under PR 13-01.

3.04 INSPECTION BY OWNER

A. Owner, and its representatives, shall have access, for purposes of inspection, at all times to all parts of the Work and to all shops wherein the Work is in preparation. Contractor shall, at all times, maintain proper facilities and provide safe access for such inspection.

B. DISTRICT REPRESENTATIVE shall have the right to reject materials and/or workmanship deemed defective Work and to require correction. Defective workmanship shall be corrected in a satisfactory manner and defective materials shall be removed from the premises and legally disposed of without charge to Owner. If Contractor does not correct such defective Work within a reasonable time, fixed by written notice and in accordance with the terms and conditions of the Contract Documents, Owner may correct such defective Work and proceed in accordance with related Articles of the Contract Documents.

C. Contractor is responsible for compliance to all applicable local, state, and federal regulations regarding codes, regulations, ordinances, restrictions, and requirements.

3.05 PROJECT INSPECTOR

A. A Project Inspector shall be employed by Owner in accordance with requirements of Title 24 of the California Code of Regulations with their duties specifically defined therein. Additional DSA certified inspectors may be employed and assigned to the Work by Owner in accordance with the requirements of California Building Standards Commission's, California Administrative Code with their duties as specifically defined in Section 4-333, 4-342, and in DSA IR A-8.

B. Inspection of Work shall not relieve Contractor from any obligation to fulfill all terms and conditions of the Contract Documents.

C. Contractor shall be responsible for scheduling times of inspection, tests, sample taking, and similar activities of the Work.

END OF SECTION 01 45 23

SECTION 01 60 00 PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for selection of products, including but not limited to:
   1. Product delivery, storage, and handling.
   2. Manufacturers' written warranties on products.
   3. Special warranties.
   4. Comparable products.

1.3 DEFINITIONS

A. Basis of Design Product Specification:
   1. A Specification in which a specific manufacturer's product is named and accompanied by the words *basis of design*, including make, model number, or other designation to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the Specification.

B. Products:
   1. Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term *product* includes the terms *material*, *equipment*, *system*, *assembly*, and terms of similar intent:
      a. Named products: Items identified by manufacturer's product name, including make, model number, or other designation shown or listed in manufacturer's published product literature current as of date of the Contract Documents.
      b. New products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
      c. Comparable product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

1.4 SUBMITTALS

A. Comparable Product Requests:
   1. Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title, and Drawing number(s) and title(s):
      a. Include data to indicate compliance with the specified requirements.
      b. Architect's action: If necessary, Architect will request additional information or documentation for evaluation within one (1) week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven (7) days

of receipt of additional information or documentation, whichever is later:
1) Form of Approval: As specified in Section 01 33 00: Submittal Procedures.
2) Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

B. Basis of Design Product Specification Submittal:
1. Comply with requirements in Section 01 33 00: Submittal Procedures. Show compliance with requirements.

1.5 QUALITY ASSURANCE

A. Compatibility of Options:
1. If Contractor is given option of selecting between two (2) or more products for use on Project, select a product compatible with products previously selected, even if previously selected products were also options:
a. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
b. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.6 WARRANTY

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents:
1. Manufacturer's warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Warranties:
1. Prepare a written document that contains appropriate terms and identification, ready for execution:
a. Specified form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
b. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time:
1. Comply with requirements in Section 01 77 00: Closeout Procedures.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:
1. Schedule delivery to minimize long-term storage at site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original

sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.

4. Inspect products on delivery to determine compliance with the Contract Documents, and to determine that products are undamaged and properly protected.

C. Storage:
   1. Store products to allow for inspection and measurement of quantity or counting of units.
   2. Store materials in a manner that will not endanger Project structure.
   3. Store products that are subject to damage by the elements under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
   4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
   5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
   6. Protect stored products from damage and liquids from freezing.
   7. Provide a secure location and enclosure at site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

PART 2 PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. Product Requirements:
   1. Provide products that comply with the Contract Documents, are undamaged, and unless otherwise indicated, are new at time of installation:
      a. Provide products complete with accessories, trim, finish, fasteners, and items needed for complete installation and indicated use and effect.
      b. Standard products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
      c. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
      d. Where products are accompanied by the phrase *as selected*, Architect will make selection.
      e. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

B. Product Selection Procedures:
   1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
   2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
   3. Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
   4. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

5. Basis of Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and characteristics based on the product named. Comply with requirements for consideration of an unnamed product by one of the named manufacturers.

C. Visual Matching Specification:
   1. Where Specifications require *match Architect's sample*, provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches:
      a. If no product available within specified category matches and complies with specified requirements, comply with requirements of Section 01 26 00: Contract Modification Procedures for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase *selected by Architect* or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration:
   1. Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
      a. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
      b. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
      c. Evidence that proposed product provides specified warranty.
      d. List of similar installations for completed projects with project names and addresses, and names and addresses of architects and owners, if requested.
      e. Samples, if requested.

PART 3 EXECUTION (NOT USED)

END OF SECTION 01 60 00

SECTION 01 74 19 - CONSTRUCTION AND DEMOLITION 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 new construction (Construction and Demolition (C&D) Waste), to foster material recovery and re-use and to minimize disposal in landfills.

1.02 RELATED SECTIONS

A. General Conditions.

B. Section 01 32 29: Project Forms.

1.03 REFERENCES

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

B. California Code of Regulations Title 14, Section 18700 et seq.

C. California Green Building Standards Code.

D. CHPS Best Practices

1.04 SYSTEM DESCRIPTION

A. Collection and separation of all C&D 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 reusing a minimum of 75% of the C&D waste generated.

1.05 SUBMITTALS

A. Per Section 01 32 29, CONTRACTOR to provide a C&D Waste Management Plan within ten (10) calendar days after the Notice to Proceed and prior to any waste removal. Submit the following to the DISTRICT REPRESENTATIVE for review and approval. Update quarterly. Include:

1. Materials to be recycled, reused, or salvaged, either onsite or offsite.
2. Estimates of C&D 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 and reuse program.
4. Permit or license and location of Project waste-disposal areas.
5. Site plan for placement of waste containers.

B. Per Section 01 32 29, CONTRACTOR to provide a C&D Waste Management Monthly Progress Report, summarizing waste generated by Project and submitted monthly with Application for Payment. Include:

1. Firm(s) accepting the recovered or waste materials.
2. Type and location of accepting facilities (landfill, recovery facility, used materials yard, etcetera). If materials are reused or recycled on the Project site, location should be designated as “on-site reuse and 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.

C. C&D Waste Management Final Compliance Report: Final update of Waste Management Plan to provide summary of total waste generated by Project.

PART 2 – PRODUCTS (Not Used)

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.

END OF SECTION 01 74 19

CLOSE-OUT FORM "A"

SUBCONTRACTOR'S AFFIDAVIT OF RELEASE OF LIEN

STATE OF CALIFORNIA COUNTY OF _____

KNOW ALL MEN BY THESE PRESENTS:

_____, being first duly sworn, deposes and says:

1. That he / she is the _____ of _____, the subcontractor who supplied, installed, and /or erected the Work described below, and that, he /she is duly authorized to make this Affidavit and Subcontractor Release:

   Project: Eastwood ES HVAC & Modernization

   Owner: Westminster School District Architect: PBK

   Work Performed: _____ Specification Section(s): _____

2. That all Work required under the subject subcontractor of the subject construction project has been performed in accordance with the terms thereof, that all material men, sub-subcontractors, mechanics, and laborers have been paid and satisfied in full and that there are no outstanding claims of any character arising out of the performance of said subcontractor which have not been paid and satisfied in full.

3. That to the best of his / her knowledge and belief, there are no unsatisfied claims for damages resulting from injury or death to any employees, sub-subcontractors, or the public at large arising out of the performance of said subcontract, or any suits or claims for any other damages of any kind, nature, or description which might constitute a lien upon the property of the Owner.

4. That he / she has received full payment of all sums due him / her for materials furnished and services rendered by the undersigned in connection with the performance of said subcontract and has and does hereby release the Owner and the Architect and his consultants and the Contractor from any and all claims of any character arising out of or in any way connected with performance of said subcontract.

ATTEST (If Corporation) _____
Name of Subcontractor

_____ _____
Secretary (By) (Title)

STATE OF _____

COUNTY OF _____

Sworn to and subscribed before me on this _____ day of _____, 20_____.

(Seal) _____
(Notary Public Signature)

SECTION 02 21 00 SURVEYS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section relates to execution of survey construction staking and addresses the following:
   1. Personnel and applicable responsibilities for surveying and staking.
   2. Procedures and time limitations.
   3. Consideration of monuments and damage.

B. Contractor shall furnish and set construction stakes and marks to establish the lines and grades required for completion of the Work as shown on the Plans and specified in the Project Specifications.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

A. Construction staking shall be performed under the direction of a licensed land surveyor or registered professional Engineer familiar with construction surveying and staking.

B. Construction staking shall be performed as necessary to control the Work. Construction stakes and marks shall be furnished and set with accuracy adequate to assure that the completed Work conforms to the lines, grades, and sections shown on the Plans.

C. Contractor shall provide a construction staking request in writing to Owner and the Engineer no less than 72 hours prior to the desired time for construction staking to be performed.

D. Construction stakes shall be removed from the site by Contractor when no longer needed. Removal and disposal of construction staking materials is the sole responsibility of Contractor.

E. In the event Contractor’s operations destroy any of the survey control points, Contractor shall replace such control points at his expense, subject to verification by the Engineer. The cost of any such verification or replacement of the control surveys will be the sole responsibility of Contractor with no additional cost to Owner. Contractor will not be allowed any adjustment in Contract Time for such verification or replacement of survey control points.

F. Contractor must preserve all Geographic Reference Stations, section corners, and all other legal property monuments of any kind during all construction and related activities. It is Contractor's responsibility to become familiar with the survey control and documentation of the site and surrounding property prior to conducting activities on the site that may potentially jeopardize such facilities.

G. Contractor shall give written notice to Owner and the Engineer at least five (5) working days in advance of any need to disturb or destroy any of the monuments of the site. Contractor

must receive approval for such destruction or disturbance from Owner and Engineer prior to conducting the work.

H. Only a professional land surveyor registered in the State of California will be permitted to perform surveying to reset or replace destroyed monuments. The professional land surveyor shall follow all rules, regulations, provisions, and laws of the State of California, as applicable for such work.

I. The cost of replacement of monuments destroyed or disturbed by Contractor will be the sole responsibility of Contractor and be at no additional cost to Owner.

END OF SECTION 02 21 00

SECTION 02 41 19 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes: Requirements including but not limited to:
1. Demolition and removal of selected site elements.
2. Salvage of existing items to be reused or recycled.
3. Accessories necessary for demolition and deconstruction.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and dispose offsite unless indicated as salvaged or reinstallation.

B. Remove and Salvage: As indicated on drawings, detach items from existing construction with care to prevent damage, and deliver salvaged material to a location designated by the District. Contractor shall be responsible for materials, fittings, fixtures, etc., and shall use the utmost care in their removal, so as to insure the least possible damage to the same or surrounding work.

C. Remove and Reinstall: Detach items from existing construction with care to prevent damage, clean and refurbish, prepare for reuse, store as necessary, and reinstall where indicated.

D. Existing to Remain: Leave existing items that are not scheduled for salvage or reuse, as is; do not remove.

E. Deconstruct: To remove by disassembling or detaching an item from a surface, using methods and equipment to successfully prevent damage to the item and surfaces; and dispose of items unless indicated as salvaged or for reinstallation.

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.5 SUBMITTALS

A. Qualification Data: Submit copies of qualifications for refrigerant recovery technician.

B. Proposed Protection Measures: Submit report, including Drawings, indicating proposed measures for protecting individuals and property, for environmental protection, dust control and noise control. Indicate proposed locations, types, and construction of barriers.

C. Schedule of Selective Demolition Activities:
1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of elevator and stairs.

5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

D. Inventory: Submit a list of items for removal and salvage and deliver to Owner prior to start of demolition.

E. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces that could be construed as damage caused by demolition operations. Submit prior to commencement of the work.

F. Statement of Refrigerant Recovery: Submit statement signed by refrigerant recovery technician responsible for recovering refrigerant, stating that refrigerant present was recovered and recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

G. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.6 QUALITY ASSURANCE

A. Owner Requirements: Coordinate with recommendations of the designated District environmental consultants for abatement of hazardous materials including: Asbestos, lead, other hazardous materials including; PCBs in transformers, fluorescent lamp recycle/disposal, radon abatement, and lead paint removal, VCT, TSI, etcetera.

B. Regulatory Requirements:
1. Demolition Standards: Comply with ASSE A10.6 and NFPA 241.
2. Comply with EPA regulations prior to commencement of the work. Comply with hauling and disposal regulations of authorities having jurisdiction.
3. Comply with applicable federal, state, and local codes for demolition work, dust and noise control, safety of structure, and debris removal.
4. Obtain required permits from authorities having jurisdiction.

C. Refrigerant Recovery Technician Qualifications: Certified by an EPA approved certification program.

D. Predemolition Conference: Conduct conference at the site.
1. Inspect and discuss condition of construction to be selectively demolished.
2. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
4. Review areas where existing construction is to remain and requires protection.

1.7 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted. Provide minimum of 72 hours' notice to Owner of demolition activities that will affect Owner's operations including but not limited to:
1. Interruption of power.
2. Interruption of utility services.
3. Excessive noise.

B. Condition of Structure: Conditions existing at time of inspection will be maintained by Owner as far as practical. Owner assumes no responsibility for actual condition of items or structures to be demolished.
   1. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
   2. Before commencing selective demolition, Owner will remove all loose items not permanently attached to the existing building(s) or structure(s).

C. Hazardous Materials:
   1. Hazardous materials shall be removed by the Contractor based on the hazardous materials report provided by the Owner and under the supervision of the Owners hazardous materials consultant.
   2. Any item listed I the report as “assumed to be asbestos containing” shall be treated as if they are asbestos containing and need to be abated.
   3. If additional hazardous materials are encountered, do not disturb; immediately notify Architect and Owner.

D. Historic Areas: Demolition and hauling equipment and other materials shall be of sizes that clear surfaces within historic spaces, areas, rooms, and openings, including temporary protection, by at least 12 inches (300 mm).

E. Storage or sale of removed items or materials on site is not permitted.

F. Traffic: Conduct operations and debris removal to ensure minimum interference with roads, streets, drives, fire lanes, walks, accessible paths, and adjacent occupied or used facilities.
   1. Do not close, block, or obstruct streets, drives, walks, or occupied or used facilities without written permission from authorities having jurisdiction. Provide alternate routes around obstructed traffic ways.

G. Explosives: Explosives are not permitted at the site.

H. Flame Cutting: Do not use cutting torches for removal until flammable materials are removed. At concealed spaces, verify conditions prior to flame cutting operations. Maintain portable fire suppression devices during flame cutting operations.

I. Environmental Controls: Use water sprinkling, temporary enclosures, or other acceptable methods to limit dust and dirt migration. Comply with governing regulations pertaining to environmental protection. Do not use water when it may create hazardous or objectionable conditions.

J. Utility Services: Maintain existing utilities and protect against damage during demolition operations.
   1. Do not interrupt utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, acceptable to Owner and governing authorities.

K. Protections: Provide temporary barriers to protect Owner's personnel and public from injury from work.
   1. Take protective measures to provide free and safe passage to occupied portions of building.
   2. Provide protection to ensure safe passage of the Owner’s personnel and the public around demolition areas and to and from occupied portions of adjacent areas, buildings, and structures.
   3. Provide shoring, bracing, or support to prevent movement, settlement, or collapse of structure or element to be demolished and adjacent facilities or work to remain.
   4. Protect existing work which becomes exposed during demolition operations.

a. Protect existing improvements, appurtenances, and conditions to remain.
b. Protect adjacent floors with coverings.
c. Protect walls, openings, roofs, and adjacent exterior construction to remain and exposed to building demolition operations.

5. Construct temporary insulated dustproof partitions to separate areas from noisy or extensive dirt or dust operations are performed. Equip partitions with dustproof doors and security locks. Refer to Drawings for location of partitions to be provided.
6. Provide temporary weather protection when exposing exterior conditions to prevent water leakage or damage to structure or interior areas of existing building.

L. Damages: Promptly repair damages caused to adjacent facilities by demolition work.

1.8 COORDINATION

A. Arrange selective demolition schedule to avoid interference with Owner's and the school's operations.

1.9 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties. Notify warrantor prior to proceeding. Existing warranties to be provided by Owner prior to the start of construction.

B. Notify warrantor on completion of selective demolition, and obtain documentation verifying existing system has been inspected and warranty remains in effect. Submit supporting documentation at closeout.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Repair Materials: Use repair materials identical to existing materials.
1. If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
2. Use materials whose installed performance equals or surpasses that of existing materials.

B. Comply with material and installation requirements specified in individual Specification Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that affected utilities have been disconnected and capped before commencing selective demolition operations.

B. Review Project Record Documents of existing construction or existing condition and hazardous material information provided by Owner. Owner does not warrant existing conditions are same as those indicated in Project Record Documents.

C. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

D. Survey of Existing Conditions: Record existing conditions with measured drawings or preconstruction photographs or video and templates.

1. 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.
2. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final work, make permanent record of measurements, materials, and construction details required to make exact reproduction.
3. For any electrical or low-voltage work to be performed in the project (including fire alarm, PA, intercom, or data), test entire system for operation prior to initiation of work. Notify Owner of any non-working components. Test entire system at the end of construction to ensure all systems operate properly.

3.2 PREPARATION

A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

B. Pest Control: Employ certified, licensed exterminator to treat building and to control rodents and vermin before and during selective demolition operations.

C. Site Access and Temporary Controls: Conduct selective demolition and debris removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities. Comply with requirements for access and protection.

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

E. Furnishings and Equipment: Cover and protect furniture, equipment, and fixtures from spoilage or damage as necessary.

F. Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.
1. Construct dustproof partitions of not less than nominal 4 inch (100mm) studs, 5/8 inch (16mm) gypsum wallboard with joints taped on occupied side, and 1/2 inch (13mm) fire retardant plywood on the demolition side.
2. Insulate partition to provide noise protection to occupied areas.
3. Seal joints and perimeter. Equip partitions with dustproof doors and security locks.
4. Protect air handling equipment.
5. Weatherstrip openings to prevent the spread of dust.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect against damage.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
2. Arrange to shut off utilities with utility companies.
3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
4. Disconnect, demolish, and remove fire suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.
    a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
    c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
    d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
    e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
    f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
    g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

3.4 POLLUTION CONTROLS

A. Dust Control: Use water mist, temporary enclosures, and suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations including, but not limited to SCAQMD Rule 403 (Fugitive Dust).
1. Do not use water when it may damage existing construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.
2. Wet mop floors to eliminate trackable dirt and wipe down walls and doors of demolition enclosure. Vacuum carpeted areas.

3.5 PROTECTION

A. Temporary Protection: Provide temporary barricades and protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
    a. Erect temporary pathways and means of egress necessary for ongoing operations compliant with Code and accessibility regulations.
    b. Provide temporary barricades and protection required to prevent injury and damage to adjacent buildings and facilities to remain.

2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
    a. Protect existing work which becomes exposed during demolition operations.
    b. Protect adjacent entrances from damage due to demolition activities.
    c. Protect existing improvements, appurtenances, and conditions to remain.
    d. Protect floors with covering.
    e. Protect walls, openings, roofs, and adjacent exterior construction to remain and exposed to building demolition operations.

4. Cover and protect furniture, furnishings, and equipment that have not been removed.

5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 01 50 00.
   a. Construct temporary insulated dustproof partitions to separate areas from noisy or extensive dirt or dust operations are performed. Equip partitions with dustproof doors and security locks.
   b. Construct dustproof partitions of not less than nominal 4 inch (100mm) studs, 5/8 inch (16mm) gypsum wallboard with joints taped on occupied side, and 1/2 inch (13mm) fire retardant plywood on the demolition side.
   c. Insulate partition to provide noise protection to occupied areas.
   d. Seal joints and perimeter. Equip partitions with dustproof doors and security locks.
   e. Protect air handling equipment.
   f. Weatherstrip openings.

6. Damage: Promptly repair damages to adjacent components cause by demolition activities.

B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
1. Strengthen or add new supports when required during progress of selective demolition.

C. Remove temporary barricades and protections where hazards no longer exist.

3.6 SELECTIVE DEMOLITION

A. Demolish and remove existing construction to the extent necessary for new work. Use methods required to complete the work within limitations of governing regulations and as follows:
1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame cutting operations. Maintain portable fire suppression devices during flame cutting operations.
5. Maintain fire watch during and for at least 24 hours after flame cutting operations.
6. Maintain adequate ventilation when using cutting torches.
7. Remove decayed, vermin infested, and dangerous or unsuitable materials and promptly dispose of offsite.
8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
9. Locate selective demolition equipment and remove debris and materials to avoid imposing excessive loads on supporting walls, floors, or framing.
10. Dispose of demolished items and materials promptly.

B. Site Access and Temporary Controls: Conduct selective demolition and debris removal operations to ensure minimum interference with roads, streets, walks, walkways, and adjacent occupied and used facilities.

C. Removed and Salvaged Items: Remove items indicated for salvage. Clean and pack or crate items after cleaning. Identify contents of containers. Store items in secure area until delivery to Owner.
   1. Transport items to Owner's storage area designated by Owner. Protect items from damage during transport and storage.

D. Removed and Reinstalled Items: Clean and repair items to functional condition adequate for intended reuse.
   1. Pack or crate items after cleaning and repairing. Identify contents of containers.
   2. Protect items from damage during transport and storage.
   3. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

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

F. Patching and Repair: Repair damage to adjacent construction caused by selective demolition operations promptly.

3.7 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in small sections. Using power driven saw, cut concrete to a depth of at least 3/4 inch (19 mm) at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.

B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.

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

D. Interior Slab on Grade: Use best practice removal methods to prevent cracking or structurally disturbing adjacent slabs or partitions. Use power saw where possible.

E. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI *Recommended Work Practices for the Removal of Resilient Floor Coverings*. Do not use methods requiring solvent-based adhesive strippers**.**

F. Below Grade Voids: Completely fill below grade areas and voids resulting from demolition work. Provide fill consisting of approved earth, gravel, or sand, free of trash and debris, stones over 6 (150mm) inches in diameter, roots, or other organic matter.

G. Partitions: Completely remove indicated interior partitions and interior finishes indicated. Leave adjacent work scheduled to remain sound and ready for patching or for new finishes.

H. Doors and Frames: Remove doors, frames, and hardware where indicated. Remove from site.
   1. Remove doors, frames, and hardware where indicated. Clean, store, and protect for reinstallation or return hardware to Owner as directed.

I. Windows: Remove existing windows where indicated. Remove associated anchors, shims, blocking, operating devices, sealant, and trim. Cut back interior finishes required for plumb surface for patching. Leave openings ready for installation of new materials and finishes.

J. Mechanical, Electrical, and Structural Elements: If unanticipated mechanical, electrical, or structural elements conflicting with intended function or design are encountered, investigate and measure both nature and extent of the conflict.
   1. Submit written report to Architect in accurate detail. Pending receipt of directive, rearrange selective demolition schedule as necessary to continue overall job progress without undue delay.
   2. HVAC Equipment: Remove air conditioning equipment without releasing refrigerants.

3.8 REMOVAL OF STRUCTURAL ELEMENTS

A. Foundation: Demolish foundation walls to a minimum depth of 12 inches (300mm) below existing ground surface. Demolish and remove below grade wood or metal construction. Break up below grade concrete slabs.

B. Pneumatic Operated Hammers: When possible, reduce use of pneumatic operated hammers. When necessary to use pneumatic tools, locate compressors as remote form occupied areas as possible.
   1. To break large pieces of concrete, isolate concrete from floor slabs and building structure to prevent structure borne vibration.

C. Saw Cutting: Locate compressors as remote as possible from occupied areas of facility.
   1. Use diamond tipped saw blades and related equipment.
   2. Saw cut portions of walls and slabs. Angle saw blade at floors and corners to cut as closely as possible to desired location.
   3. Control runoff water used with saw to prevent damage to existing materials.

3.9 ROOF REMOVAL

A. Roof Assembly: Remove existing roofing to the extent that can be covered in one day by new roofing. Maintain building interior in watertight and weathertight condition.
   1. Remove existing roof membrane, flashings, copings, and roof accessories.
   2. Remove existing roofing system down to substrate.

B. At new column extensions, cut through roofing as required for welding of new extension. Provide temporary watertight enclosure over stubs and temporarily flash to existing roof to make completely watertight.

C. At existing parapets, remove portions of roofing, flashing, stone, and masonry necessary to weld new steel and set form work. Provide temporary watertight enclosures over areas of open roof and temporarily flash to make watertight.

D. As column forms are placed, temporarily flash columns to existing roofing and cover with watertight tarpaulins before and after pouring. After column forms have been removed, temporarily flash new concrete structure into existing roofing immediately to maintain watertight roof.

E. When removing roofing to place supports for shoring of form work to transfer loads to existing columns or approved structure or to support scaffolding, work platforms, or similar loads, temporarily flash supports to make roof watertight.

F. Remove excess residue. Thoroughly clean and remove asphalt, dust, loose materials and leave ready for new work.

3.10 PATCHING AND REPAIRS

A. Promptly repair damage to adjacent construction caused by selective demolition operations.

B. Patching: Comply with Section 01 73 29.

C. Repairs: When necessary to repair to existing surfaces, patch to produce surfaces suitable for new materials.
   1. Fill holes and depressions in existing masonry walls to remain with masonry patching material applied according to manufacturer's written recommendations.

D. Finishes: Restore exposed finishes of patched areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing.

E. Floors and Walls: Where walls or partitions are demolished, extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
   1. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.
   2. Where patching occurs in a painted surface, apply primer and intermediate paint coats over patch and apply final paint coat over entire unbroken surface containing patch. Provide additional coats until patch blends with adjacent surfaces.
   3. Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.

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

3.11 DISPOSAL OF DEMOLISHED MATERIALS

A. Legally remove demolition waste materials from site and dispose in an EPA approved construction and demolition waste landfill acceptable to authorities having jurisdiction recycle or reuse components.
   1. Do not allow demolished materials to accumulate on site.
   2. Remove and transport debris to prevent spillage on adjacent surfaces and areas.
   3. Remove debris from elevated portions of building by chute, hoist, or devices that conveys debris to grade level in a controlled descent.
   4. Comply with requirements specified in Section 01 74 19.

B. Burning: Do not burn demolished materials.

3.12 CLEANING

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

END OF SECTION 02 41 19

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of Division 01 apply to this section

B. Section Includes:

1. Cast-in-place concrete placement and finishing.

1.02 SUBMITTALS

A. Shop Drawings: Submit Shop Drawings indicating locations of cast-in-place concrete Work and accessory items such as vapor barriers. Include details and locations of reinforcing, embedded items, and interfacing with other Work.

B. Product Data:

1. Mix Design: Submit a concrete mix design for each mix that will be provided for the Work. Include water/ cement ratio, size of coarse aggregate and amount of any admixture, Dry Shrinkage Data. Predict minimum compressive strength, maximum slump and air content percentage. Mix design shall be stamped and signed by a Civil Engineer licensed in the State of California.

2. Manufacturer of ready-mixed concrete shall deliver to the IOR a certificate with each mixer truck. Certificate shall bear the signature of representative of the testing laboratory, and shall state quantity of cement, water, fine and coarse aggregate and admixtures.

C. Material Samples: Submit Samples illustrating concrete finishes, minimum 12 inches x 12 inches in size.

D. Certificates: Submit a notarized certificate that each of following conforms to standards indicated:

1. Aggregates – ASTM Standards C33

2. Admixtures - ASTM Standards C260

3. Curing materials - ASTM Standards C171

1.03 QUALITY ASSURANCE

A. Comply with the following as a minimum requirement.

B. American Concrete Institute (ACI) Publication:

1. ACI 318 - 14 - Recommended Practice for Structural Concrete
2. ACI 211 - Recommended Practice for Selecting Proportions of Concrete.
3. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.
4. ACI 305 - Recommended Practice for Hot Weather Concreting.
5. ACI 306 - Recommended Practice for Cold Weather Concreting.
6. ACI 308 - Recommended Practice for Curing Concrete.
7. ACI 309 - Recommended Practice for Consolidation of Concrete.

C. American Society for Testing and Materials (ASTM) Standards:

1. ASTM A 185 - Welded Steel Wire Fabric For Concrete Reinforcement.
2. ASTM C 31 - Making and Curing Concrete Test Specimens in the Field.
3. ASTM C 33 - Concrete Aggregates.
4. ASTM C 39 - Compressive Strength of Cylindrical Concrete Specimens.
5. ASTM C 88 - Soundness of Aggregates by use of Sulphate or Magnesium Sulphate.
6. ASTM C 94 - Ready-Mixed Concrete.
7. ASTM C 143 - Slump of Hydraulic Cement Concrete.
8. ASTM C 150 - Portland Cement.
9. ASTM C 171 - Sheet Materials for Curing Concrete.
10. ASTM C 172 - Sampling Freshly Mixed Concrete.
11. ASTM C 173 - Air Content of Freshly Mixed Concrete by the Volumetric Method.
12. ASTM C 227 - Potential Alkali Reactivity of Cement-Aggregate Combinations (Mortar-Bar Method).
13. ASTM C 231 - Air Content of Freshly Mixed Concrete by the Pressure Method.
14. ASTM C 260 - Air-Entraining Admixtures for Concrete.
15. ASTM C 289 - Potential Reactivity of Aggregates (Chemical Method).

16. ASTM D 1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).

D. Continuous inspection shall be provided at the batch plant and for transit-mixed concrete to run check sieve analysis of aggregate, check moisture content of fine aggregate, check design of mix, check cement being used with test reports, check loading of mixer trucks, and certify to quantities of materials placed in each mixer truck.

E. Inspection shall be performed by a representative of a testing laboratory selected by the Owner. Owner will pay for inspection costs. Notify the laboratory 24 hours in advance of time concrete is to be mixed. Notify the laboratory of postponement or cancellation of mixing within at least 24 hours of scheduling time.

F. Continuous batch plant inspection requirement may be waived in accordance with CBC section 1705A.3.3.1 Waiver shall be in writing, including DSA approval.

G. Strength Test of Concrete: Refer to Section 01420: Testing and Inspection.

1.04 DELIVERY, STORAGE AND HANDLING

A. Mixing and Placing Concrete: Refer to Section 01420: Testing and Inspection.

B. Ready-mix concrete shall be mixed and delivered in accordance with ASTM C 94 and CBC Standard 19-3 and 19-4. Each batch of concrete delivered to the Project site shall be accompanied by a time slip bearing departure time and signature of batch plant supervisor. Concrete shall be placed within 90 minutes after start of mixing.

C. Store cement and aggregate materials so as to prevent their deterioration or intrusion by foreign matter. Deteriorated or contaminated materials shall not be furnished.

1.05 JOB CONDITIONS

A. Cold Weather Requirements:

1. Adequate equipment shall be provided for heating concrete materials and protecting concrete during freezing or near-freezing weather. Surfaces, in which concrete is to come in contact with, shall be free from frost or ice. No frozen materials or materials containing ice shall be furnished.

2. When placing concrete during freezing or near-freezing weather the mix shall have a temperature of at least 50 degrees F., but not more than 90 degrees F. when cement is added. Concrete shall be maintained at a temperature of at least 50 degrees F. for at least 72 hours after placing or until it has thoroughly hydrated. When necessary, concrete materials shall be heated before mixing. Special precautions shall be provided for protection of transit-mixed concrete.

B. Hot Weather Requirements: During hot weather, proper attention shall be provided for ingredients, production methods, handling, placing, protection and curing, to prevent excessive concrete temperatures or water evaporation which could impair required strength or durability.

PART 2 - PRODUCTS

2.01 GENERAL

A. Ready-Mixed Concrete: Mix and deliver in accordance with requirements of ACI 318, Section 5.8.2.

B. Strength of Concrete: Concrete, unless otherwise indicated or specified, shall be provided with a minimum ultimate 28-day strength of **3000 psi** (f'c). For high-early-strength concrete, age for reaching the f'c shall be as indicated on Drawings.

C. Shrinkage Test:

1. Five weeks before placing any concrete, prepare a trial batch of each mix design, using the same aggregates, cement and admixtures (if any) proposed for use on the Project. Prepare at least 3 specimens for determining the "drying shrinkage" of the mix design.

2. The "drying shrinkage" specimens shall be 4" x 4" x 11" prisms, made, cured, dried and measured as speci¬fied in ASTM C 157. Measure and report separately for 7, 14, 21 and 28 days of drying, after 7 days of moist curing. The effective gauge length of the specimens shall be 10".

3. The average "drying shrinkage" of the test specimens after 28 days of drying shall not exceed 0.0042 in.

2.02 MATERIALS

A. Cement: ASTM C 150. Furnished cement shall be as selected and reviewed for concrete proportioning.

B. Aggregates: Aggregates shall conform to ASTM C 33 and C 227 except as modified herein. Any suitable individual grading of coarse aggregate may be furnished, provided Grading of Combined Aggregate indicated in following table is obtained. Refer to Section 01420: Testing and Inspection.

GRADING OF COMBINED AGGREGATE

Sieve Number or	**1-1/2"**	**1"**	**3/4"**
Size in Inches	**Maximum**	**Maximum**	**Maximum**
Passing a 2"	------	------	------
Passing a 1-1/2"	95-100	------	------
Passing a 1"	70-90	90-100	------
Passing a 3/4"	50-80	70-95	90-100
Passing a 3/8"	40-60	45-70	55-75
Passing a No. 4	35-55	35-55	40-60
Passing a No. 8	25-40	27-45	30-46
Passing a No. 16	16-34	20-38	23-40
Passing a No. 30	12-25	12-27	13-28
Passing a No. 50	2-12	5-15	5-15

Passing a No. 100	0-3	0-5	0-5

C. Water: Water shall be potable and free from deleterious matter.

D. Admixtures: CBC Chapter 19A, Section 1903A.6, Type A or D.

E. Expansion Joint Fillers: Preformed strips, non-extruding and resilient bituminous type, of thickness indicated, conforming to ASTM D 1751.

F. Curing Paper and Liquid Curing Compounds:

1. Curing Paper: A standard brand conforming to ASTM C 171, Type 1 - Regular, Kure-N-Seal.

2. Liquid Curing Compounds: A standard brand, clear liquid conforming to ASTM C 309, Master Builders, Grace, Antihydro.

G. Abrasive Aggregate: Norton Alundum, Union Carbide Carborundum, or equal, graded #12 through #30 sizes, color as selected by Architect.

H. Underlayment: Latex underlayment for filling low spots in concrete shall be Tile-Tex by Flintkote Co., Webtex #60 or Fixallatex by Dowman Products Co.

I. Vapor Barrier: ASTM D 21O3, polyethylene sheeting, clear, 10 mils minimum thickness, impact strength greater than 70 grams per mil, 10 feet minimum width. Provide minimum 2-inch wide waterproof plastic self-adhering tape for sealing edges and ends of sheeting.

1. Moisture barrier is required where an interior area is scheduled to receive moisture sensitive floor finishes.

J. Stair Strips and Nosing:

1. Fabricated from 6063-T5 extruded aluminum, mill finish. Anti-slip filler shall contain at least 60 percent virgin grain aluminum oxide abrasive. Binder shall be fully cured resilient type epoxy, with binder-to-filler ratio of 13 percent. The epoxy-abrasive filler shall extend over the curved front edge of the nosing and shall be securely bonded to the extruded aluminum base.

2. Manufactured by Wooster Products Inc. American Safety Tread Co. Inc., or equal.

3. Nosing and strips for concrete casting shall be provided with Sure-Hold anchors, chevron shaped continuous full length of nosing or strip.

4. Nosings and anchors for attachment to hydrated concrete stairs and wood stairs shall be similar to those specified below, except they shall be provided with countersunk holes for screws and fasteners.

5. Colors: As selected by Architect to contrast with stair color. Colors shall extend uniformly through the filler.

6. Strip and Nosing Types:

a. Nosings for sloped riser steel pan stairs: Type WP4J, 4-1/16 inches wide, 3/8 inch thick.

b. Nosings for new concrete stairs: Type WP4C, 4-1/16 inches wide, 3/8 inch thick, nose projects down 1/4 inch.

c. Nosings for square edged steel pan stairs: Type WP4SP, 4-1/16 inches wide, 3/8 inch thick nose.

d. Strips for recessing into concrete stairs: Type WP1A, except 2-1/4 inches wide, 3/8 inch thick. American Safety Tread Co., Type 24, or equal.

e. Strips for adhering to existing or hydrated concrete: Flex-Tred anti-safety strips, minimum 2-1/4 inches wide. Cut from rolls and round corners.

f. Strips for anchoring into wood or stone: American Safety Tread Co., Type 24H, or equal, with holes for fasteners, 2-1/4 inches wide.

PART 3 - EXECUTION

3.01 GENERAL

A. Time of Placing: Do not place concrete until reinforcement, conduits, outlet boxes, anchors, hangers, sleeves, bolts, and other embedded materials are securely fastened in place. Contact the IOR at least 24 hours before placing concrete; do not place concrete until inspected by the IOR.

B. Pouring Record: A record shall be kept on the Project site of time and date of placing concrete in each portion of structure. Such record shall be maintained on the Project site until Substantial Completion and shall be available for examination by the Architect and DSA.

3.02 PREPARATION

A. Moisture Barrier: Before installation of screeds and slab reinforcement, install a moisture barrier under slabs on grade. Place membrane in as large sheets as possible, lapped 12 inches at sides and ends, with top lap placed in the direction of the spreading of concrete. Extend membrane and lap at least 4 inches onto adjoining wall surfaces and seal with pressure-sensitive tape.

1. Install moisture barrier on minimum 2-inch bed of sand, unless otherwise indicated, over gravel base as indicated on the Drawings.

2. Patch punctures and tears in moisture barrier.

C. Reglets and Rebates:

1. Form reglets and rebates in concrete to receive flashing, frames and other equipment as detailed and required. Coordinate dimensions and locations required with other related Work.

2. If concrete slabs on grade adjoin a wall or other perpendicular concrete surface, form a reglet in wall to receive and carry horizontal concrete Work. Reglet shall be full thickness of the slab and shall be 3/4 inch wide, unless otherwise indicated. Requirement does not apply to exterior walks, unless specifically indicated.

D. Anchor Slots: Dove-tail anchor slots at concrete walls to receive masonry veneer shall be set vertically in forms, 24 inches maximum on centers measured horizontally. Anchor slots shall be No. 24 gage galvanized sheet steel with removable fiber filler to prevent seepage of cement in slot.

E. Screeds: Install screeds accurately and maintain at required grade or slab elevations after steel reinforcement has been installed , but before starting to place concrete. Install screeds adjacent to walls and in parallel rows not to exceed 8 feet on centers.

3.03 INSTALLATION

A. Conveying and Placing:

1. Concrete shall be placed only under direct observation of the IOR. Do not place concrete outside of regular working hours, unless the IOR has been notified at least 48 hours in advance.

2. Concrete shall be conveyed from mixer to location of final placement by methods, which will prevent separation or loss of materials.

3. Concrete shall be placed as nearly as practicable to its final position to avoid segregation due to re-handling or flowing. No concrete that has partially hydrated or has been contaminated by foreign materials shall be placed, nor shall re-tempered concrete or concrete which has been remixed after initial set be placed.

4. In placing concrete in columns, walls or thin sections, provide openings in forms, elephant trunks, tremies or other recognized devices, to prevent segregation and accumulation of partially hydrated concrete on forms or metal reinforcement above level of concrete being placed. Such devices shall be installed so that concrete will be dropped vertically. Unconfined vertical drop of concrete from end of such devices to final placement surface shall not exceed 6 feet.

5. Concrete shall be placed as a continuous operation until placing of panel or section is completed. Top surfaces of vertically formed lifts shall be level.

6. Concrete shall be thoroughly consolidated during placement, and shall be worked around reinforcement and embedded fixtures with mechanical vibrators.

7. Where conditions make consolidation difficult, or where reinforcement is congested, batches of mortar containing same proportions of cement, sand, and water as provided in the concrete, shall first be deposited in the forms to a depth of at least one inch.

B. Compaction and Screeding:

1. Tamp freshly placed concrete with a heavy tamper until at least 3/8 inch of mortar is brought to surface. Concrete shall then be tamped with a light tamper and screeded with a heavy straightedge until depressions and irregularities are eliminated, and surface is true to finish grades or elevations. Remove excess water and debris.

2. Where slabs are to receive separate cement finish or mortar setting bed, continued tamping to raise mortar to surface is not performed. Laitance shall be removed by brushing with a stiff brush or by light sandblasting to expose clean top surface of coarse aggregate.

C. Floating and Troweling:

1. When concrete has hydrated sufficiently, it shall be floated to a compact and smooth surface. After floating, wait until concrete has reached proper consistency before troweling. Top surfaces shall receive at least 2 troweling operations with steel hand trowel. Prior to and during final troweling, apply a fine mist of water frequently with an atomizing type fog sprayer. Omit troweling for slabs to receive a separate cement finish.

2. For interior finish slabs, final troweling shall provide a hard, impervious, and non-slip surfaces, free from defects and blemishes. Finished surface shall be within a tolerance of 1/8 inch in 10 feet. Avoid burnishing. Do not add cement or sand to absorb excess moisture.

   a. Floor of Walk-In Refrigerator: Finish as specified above, to a smooth finish.

   b. At gymnasium locker room floors shall be given a fine broom finish. After floating, and while the surface is still plastic, provide a fine textured finish by drawing a fine fiber bristle broom uniformly over the surface in one direction only. Floors sloped for drainage should be brushed in the direction of flow.

3. Exterior Paving and Cement Walks: Finish as specified above, except surface shall be given a non-slip broom finish to match Sample reviewed by the Architect.

   a. Provide medium broom finish on surfaces less than 5%, and heavy broom finish on surfaces at 5% or greater.

4. Vertical concrete surfaces shall be finished smooth and free from marks or other surface defects.

D. Curing:

1. Concrete shall be maintained above 50 degrees F., and in a moist condition for 7 days after placing, except that high early strength concrete shall be maintained in a moist condition for 3 days.

2. Before applying curing paper, interior floor treated with colored hardener shall be given a heavy protective coat of colored wax left unpolished, and then immediately covered with paper. If wax is not applied within two hours after final troweling, concrete shall be sprayed with a fine water mist and maintained continuously moist until wax is applied, unless spraying is not recommended by hardener manufacturer. After other Work such as plastering and painting has been completed, curing paper shall be removed and waxed floors cleaned of protective wax coating.

3. Forms containing concrete, top of concrete between forms, and exposed concrete surfaces after removal of forms shall be maintained in a thoroughly wet condition for at least 7 consecutive days after placing.

4. If weather is hot or surface has dried out, spray surface of concrete slabs and paving with fine mist of water, starting not later than 2 hours after final troweling and continuing until sunset. Surface of finish shall be kept continuously wet until curing medium has been installed.

5. Immediately after finishing, roof slabs and monolithic floor finish to receive resilient floor covering shall be uniformly and completely coated with liquid curing compound.

    a. Install compound in a manner and quantity sufficient to produce a uniform continuous thin film of water-impervious membrane. Compound shall be installed in accordance with manufacturer's directions.

    b. Protect adjoining surfaces from damage during installation. If curing compound is not applied immediately, cover finished concrete with wet burlap or curing paper and keep concrete surface wet for a period not to exceed thirty hours following finishing of concrete. At end of that time, burlap or paper shall be removed and curing compound installed as specified above.

5. Immediately after finishing, monolithic floor slabs not scheduled to receive resilient floor covering shall be covered with curing paper. Paper shall be lapped 3 inches at joints and sealed with waterproof sealer. Edges shall be cemented to finish. Repair or replace paper damaged during construction operations.

6. Within 24 hours after finishing, exterior slabs and paving, and interior slabs to receive cement topping or mortar setting beds, shall be covered with sand to a depth of 2 inches and kept thoroughly wet for 7 days.

    a. Instead of sand covering, exterior walks and paving where no other surface treatment is specified, may be cured with clear liquid curing compound immediately installed in accordance with manufacturer's directions.

E. Filling, Leveling and Patching:

1. Concrete slabs exhibiting high or low spots and indicated to receive resilient floor covering or soft floor covering, shall have surfaces repaired. High spots shall be honed, or ground with power-driven machines to required tolerances. Low spots shall be filled with latex underlayment, installed in strict accordance with manufacturer's written recommendations.

2. Holes resulting from form ties or sleeve nuts shall be solidly packed, through exterior walls, by pressure grouting with cement grout, as specified. Grouted holes on exposed surfaces shall be screeded flush and finished to match adjoining surfaces.

F. Cement Base: Cement base shall be of the height, thickness, and shape detailed. Base shall be reinforced with one inch mesh, 18 gage, zinc-coated wire fabric. Base finish mixture shall be one part Portland cement, 2 parts of fine aggregate and one part pea gravel. Colored cement base shall include a chemically inert mineral oxide pigment in the mix.

3.04 FINISHING

A. Soda and Acid Wash: Concrete surfaces to receive plaster, paint or other finish, and which have been formed by oil coated forms, shall be scrubbed with a solution of 1-1/2 pounds of caustic soda to one gallon of water. Surfaces where smooth wood or waste molds have been furnished shall be scrubbed with a solution of 20 percent muriatic acid. Wash with clean water after scrubbing.

B. Sacking: Exposed concrete curbs, walls, and other surfaces shall be sacked by an application of Portland cement grout, floated, and rubbed. Sacking shall not be performed until patching and filling of holes has been completed. Entire sacking operation for any continuous area shall be started and completed within the same day.

1. Mix one part portland cement and 1-1/2 parts fine sand with sufficient water to produce a grout having consistency of thick paint. Wet surface of concrete sufficiently to prevent absorption of water from grout. Apply grout uniformly with a brush or spray gun, then immediately float surface with a cork or other suitable float, scouring wall vigorously.

2. While grout is still plastic, finish surface with a sponge-rubber float, removing excess grout. Allow surface to dry thoroughly, then rub vigorously with dry burlap to completely remove dried grout. No visible film or grout shall remain after rubbing with burlap.

C. Sandblasting: Exterior concrete surfaces to receive stucco dash coat finish, where plywood or other smooth forms have been furnished, shall be uniformly sand-blasted with sharp quartz sand under sufficient air pressure to remove dirt, form oil and other foreign materials, and roughen surface to provide a proper bond. Such surfaces shall be thoroughly washed with clean water after sandblasting.

D. Abrasive: Concrete stair treads, landings, ramps and steps on interior and exterior of buildings, and interior exposed concrete floors in shop buildings shall receive an abrasive finish. Abrasive grains in amount of 30 pounds per 100 square feet shall be evenly installed by dust-on method and embedded into surface during first troweling operation. Additional abrasive grains, in amount of 30 pounds per 100 square feet, shall then be evenly installed and embedded into surface during final troweling operation.

E. Floor Hardener: Exposed interior concrete floors throughout shall be treated with floor hardener, as specified. Install hardener after surface of concrete has reached the point where no excess moisture is present, but while it is still plastic. Hardener shall be installed as follows:

1. Colored Hardener: Install at rate of 40 pounds per 100 square feet of surface for initial application.

2. Gray (natural) Hardener: Install at rate of 20 pounds per 100 square feet of surface for initial application.

3. Hardener shall be evenly distributed and thoroughly floated into surface mortar with a wood float. An additional 20 pounds of hardener, colored or gray, specified as above, shall be installed over each 100 square feet, and troweled to an even surface having uniform color and texture.

F. Cement Grout and Dry-Pack Concrete: Cement grout shall be mixed at the Project site and shall be composed of one volume of portland cement and 2-1/2 volumes of fine aggregate. Materials shall be mixed dry with sufficient water added to make mixture flow under its own weight. When grout is used as a dry pack concrete, add sufficient water to provide a stiff mixture, which can be molded into a sphere.

G. Broom Finish: Exterior stair treads and landings shall be provided with a non-slip broom finish in addition to abrasive finish specified.

H. Abrasive Stair Nosing: Nosing shall be installed according to manufacturers written recommendations.

3.05 EXPANSION AND CONSTRUCTION JOINTS

A. Construction Joints: Details and proposed location of construction joints shall be as indicated on the Drawings, located to least impair strength of structure, in accordance with the following:

1. Thoroughly clean contact surface by sand blasting entire surface not earlier than 5 days after initial placement.

2. A mix containing same proportion of sand and cement provided in concrete plus a maximum of 50 percent of coarse aggregate shall be placed to a depth of at least one inch on horizontal joints. Vertical joints shall be wetted and coated with a neat cement grout immediately before placing of new concrete.

3. Should contact surface become coated with earth, sawdust, or deleterious material of any kind after being cleaned, entire surface shall be re-cleaned before applying mix.

B. Expansion Joints: Provide expansion joints where indicated in walks and exterior slabs. Space approximately 15 feet apart, unless otherwise indicated. Joints shall extend entirely through slab with joint filler in one piece for width of walk or slab. Joint filler shall be 3/8 inch thick, unless otherwise indicated.

C. Tooled Joints: Slabs, walks and paving shall be marked into areas as indicated with markings made with a V-grooving tool. Marks shall be round-edged, free from burrs or obstructions, with clean cut angles and shall be straight and true. Walks, if not indicated, shall be marked off into rectangles of not more than 12 square feet and shall have a center marking where more than 5 feet wide.

3.06 TESTING

A. Molded Cylinder Tests:

1. Owner Consultant will prepare cylinders. Each cylinder shall be dated, given a number, point in structure from which sample was obtained, mix design number, mix design strength and result of accompanying slump test noted.

2. Separate tests of molded concrete cylinders obtained at same place and time shall be made at age of 3 days, 7 days, and 28 days. A strength test shall be the average of the compressive strength of 2 cylinders, obtained from the same sample of concrete and tested at 28 days or at test age designated for determination of f'c.

3. Test cylinders shall be prepared at the Project site and stored in testing laboratory in accordance with ASTM C 31, and tested in accordance with ASTM C 39.

B. Core Test (Waived)~~: At request of the Architect, cores of hardened concrete shall be cut from portions of hydrated structures for testing, in accordance with CBC and ASTM C 42.~~

~~1. Provide 4 inch diameter cores at representative places throughout the structure as designated by the Architect.~~

~~2. In general, provide sufficient cores to represent concrete placed with at least one core for each 4,000 square feet of building area, and at least 3 cores total for each Project.~~

~~3. Where cores have been removed, fill voids with drypack, and patch the finish to match the adjacent existing surfaces.~~

C. Concrete Consistency: Measure consistency according to ASTM C 143. Test twice each day or partial day's run of the mixer.

D. Adjustment of Mix: If the strength of any grade of concrete for any portion of Work, as indicated by molded test cylinders, fall below minimum 28 days compressive strength specified or indicated, adjust mix design for remaining portion of construction so that resulting concrete meets minimum strength requirements.

E. Defective Concrete:

1. Should strength of any grade of concrete, for any portion of Work indicated by tests of molded cylinders and core tests, fall below minimum 28 days strength specified or indicated, concrete will be deemed defective Work and shall be replaced or adequately strengthened in a manner acceptable to the Architect and DSA.

2. Concrete Work that is not formed as indicated, is not true within 1/250 of span, not true to intended alignment, not plumb or level where so intended, not true to intended grades and levels, contains sawdust shavings, wood or embedded debris, or does not fully conform to Contract provisions, shall be deemed to be defective Work and shall be removed and replaced.

F. Concrete For Equipment Pads, Mechanical and Electrical Work: Unless otherwise indicated, strength shall be 3,000 psi concrete. Exposed concrete shall be provided with a hand trowel

finish with radius corners and edges. Form and place concrete where necessary as described in Section 03100: Concrete Forms and Accessories, and reinforced as described in Section 03200: Concrete Reinforcement. Calcium chloride shall not be furnished in any concrete mix provided for the installation of underground electrical conduits. For concrete encasement of more than one conduit, furnish 3/4 inch to 1 inch aggregate as specified for concrete mix.

3.07 CLEAN UP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

3.08 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.09 RESPONSIBILITY FOR FIELD RFI:

A. Concrete sub-contractor shall be responsible for generate RFI related to concrete issues in quality engineering sketches by a qualified detailer. Accompany RFI's with partial structural foundation or framing plans showing location in question and affected structural members. Copy partial plan from structural drawings and indicate grid line locations and floor level. Also provide properly drawn engineering sketches illustrating issues and Contractor's proposed solutions. Photographs are not acceptable substitutes to engineering sketches.

END OF SECTION

SECTION 05 50 00 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes: Requirements including but not limited to:
   1. Steel framing and supports for countertops.
   2. Steel framing and supports for mechanical and electrical equipment.
   3. Support angles for elevator door sills.
   4. Steel shapes for supporting elevator door sills.
   5. Metal ladders.
   6. Pipe bollards.
   7. Accessories necessary for a coordinated and complete installation.

1.3 RELATED SECTIONS

A. Section 03 30 00: Cast In Place Concrete.

B. Section 05 40 00: Cold-Formed Steel Framing.

C. Section 09 24 00: Cement Plastering.

D. Section 09 21 16: Gypsum Board Assemblies.

E. Section 09 90 00: Painting and Coatings.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance of Ladders: Provide ladders and landings capable of withstanding the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.

B. Structural Performance:
   1. Countertops and Vanities: Provide countertop and vanity framing capable of withstanding the following structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections, or of exhibiting excessive deflections in any of the components making up the countertops and vanities:
      a. All deadloads.
      b. 500 pound live load placed on the countertop and vanity.
      c. Deflection at Midspan: L/1000 times span or 1/8 inch whichever is less.

C. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 degrees F (67 degrees C), ambient; 180 degrees F (100 degrees C), material surfaces.

1.5 SUBMITTALS

A. Product Data: Submit data for miscellaneous metal fabrications and paint, coatings, and grout accessories.

B. Shop Drawings: Submit shop drawings detailing the fabrication and erection of each metal fabrication indicated: ladders, racks, platforms and other specified within. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
   1. For installed products indicated to comply with design loads, include structural analysis data, for information only, signed and sealed by the qualified professional engineer responsible for their preparation.

C. Welding certificates.

D. Paint Compatibility Certificates: Submit manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Building Code: Comply with applicable provisions of the CBC 2022 California Building Code (CCR Title 24, Part 2, as adopted and amended by DSA).
   2. Welding: Qualify procedures and personnel according to the following:
      a. AWS D1.1/D1.1M Structural Welding Code - Steel.
      b. AWS D1.2/D1.2 M Structural Welding Code - Aluminum.
      c. AWS D1.6/D1.6M Structural Welding Code - Sheet Steel.
      d. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

B. Fabricator/Installer Qualifications: A firm experienced in producing metal fabrications similar to those indicated for this Project for a minimum of 5 years, with a record of successful in service performance, with sufficient production capacity to produce required units without causing delay in the work.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.
   1. Established Dimensions: Where field measurements cannot be made without delaying the work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
   2. Provide allowance for trimming and fitting at site.

1.8 STORAGE, DELIVERY AND HANDLING

A. Store metal fabrications in a dry, well ventilated, weathertight place. Deliver and handle so as to prevent any type of damage to the fabricated work.

1.9 COORDINATION

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

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MATERIALS

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

B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Stainless Steel Sheet, Strip, and Plate: ASTM A 240/A 240M or ASTM A 666, Type 304.

D. Stainless Steel Bars and Shapes: ASTM A 276, Type 304.

E. Rolled Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

F. Rolled Stainless Steel Floor Plate: ASTM A 793.

G. Abrasive Surface Floor Plate: Steel plate with abrasive granules rolled into surface or with abrasive material metallically bonded to steel.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. IKG Industries, a division of Harsco Corporation.
      b. SlipNOT Metal Safety Flooring; W.S. Molnar Company.

H. Steel Tubing: ASTM A 500/A 500M, cold formed steel tubing.

I. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.

J. Zinc Coated Steel Wire Rope: ASTM A 741.
   1. Wire Rope Fittings: Hot dip galvanized steel connectors with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.

K. Slotted Channel Framing: Cold formed metal box channels (struts) complying with MFMA-4.
   1. Size of Channels: 1-5/8 inches by 1-5/8 inches (41 mm by 41 mm).
   2. Material: Galvanized steel, ASTM A 653/A 653M, commercial steel, Type B. with G90 (Z275) coating; [0.108 inch (2.8 mm) nominal thickness.
   3. Cold Formed Metal Channels: Flange edges returned toward web and with 9/16 inch (14.3 mm) wide slotted holes in webs at 2 inches (51 mm) o.c.
   4. Width of Channels: 1-5/8 inches (41 mm).
   5. Depth of Channels: Indicated on Drawings.
   6. Metal and Thickness: Galvanized steel complying with ASTM A 653/A 653M, structural quality, Grade 33 (Grade 230), with G90 (Z275) coating; 0.108 inch (2.8mm) nominal thickness.
   7. Finish: Hot dip galvanized after fabrication.

L. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

M. Aluminum Plate and Sheet: ASTM B 209 (ASTM B 209M), Alloy 6061-T6.

N. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T6.

O. Aluminum Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.

P. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

Q. Nickel Silver Extrusions: ASTM B 151/B 151M, Alloy UNS No. C74500.

R. Nickel Silver Castings: ASTM B 584, Alloy UNS No. C97600 (20 percent leaded nickel bronze).

S. Fasteners: Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
   1. Provide stainless steel fasteners for fastening aluminum.
   2. Provide stainless steel fasteners for fastening stainless steel.
   3. Provide stainless steel fasteners for fastening nickel silver.
   4. Provide bronze fasteners for fastening bronze.
   5. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
   6. Steel Bolts and Nuts: Regular hexagon head bolts, ASTM A 325, Type 3 (ASTM A 325M, Type 3); with hex nuts, ASTM A 563, Grade C3 (ASTM A 563M, Class 8S3); and, where indicated, flat washers.
   7. Stainless Steel Bolts and Nuts: Regular hexagon head annealed stainless steel bolts, ASTM F 593 (ASTM F 738M); with hex nuts, ASTM F 594 (ASTM F 836M); and, where indicated, flat washers; Alloy.
   8. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
      a. Hot dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
   9. Anchors: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
   10. Cast in Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot dip galvanized per ASTM F 2329.
   11. Post Installed Anchors: Torque controlled expansion anchors.
      a. Material for Interior Locations: Carbon steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
      b. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy **Group 1 (A1)** stainless steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).
   12. Slotted Channel Inserts: Cold formed, hot dip galvanized steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches (41 by 22 mm) by length indicated with anchor straps or studs not less than 3 inches (75 mm) long at not more than 8 inches (200 mm) o.c. Provide with temporary filler and tee head bolts, complete with washers and nuts, all zinc plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

T. Miscellaneous Materials:

1. Shop Primer for Ferrous Metal: Universal primer, organic zinc rich primer, complying with SSPC-Paint 20 and compatible with topcoat. Provide 10-99 (red) or 10-09 (gray) by Tnemec Company.
2. Universal Shop Primer: Fast curing, lead and chromate free, universal modified alkyd primer and compatible with topcoat. Use primer containing pigments that make it easily distinguishable from zinc rich primer.
3. Water Based Primer: Emulsion type, anticorrosive primer for mildly corrosive environments that is resistant to flash rusting when applied to cleaned steel and compatible with topcoat.
4. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc coated metal and compatible with finish paint systems indicated.
5. Galvanizing Repair Paint: High zinc dust content paint for regalvanizing welds in steel, complying with SSPC-Paint 20. Provide Tneme-Zinc 90-97 by Tnemec Company.
6. Bituminous Paint: Cold applied asphalt emulsion complying with SSPC-Paint 12, containing no asbestos fibers, or cold applied asphalt emulsion complying with ASTM D 1187 ASTM D 1187/D 1187M.
7. Nonshrink, Nonmetallic Grout: Factory packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
8. Concrete Materials and Properties: Composed of ASTM C150 Type I Portland cement, ASTM C33 sand and coarse aggregates and potable water to produce a low slump mix suitable for placement. Grade coarse aggregate from 1/8” with at least 95 % passing a 3/8” sieve and not more than 10% passing a No. 8 sieve. Fill shall be proportioned to provide a minimum 28 day compressive strength of 3000 psi (20 MPa).

2.2 FABRICATION

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
   1. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
   2. Form bent metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
   3. Form exposed work with accurate angles and surfaces and straight edges.
   4. Weld corners and seams continuously to comply with the following:
      a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
      b. Obtain fusion without undercut or overlap.
      c. Remove welding flux immediately.
      d. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
   5. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
   6. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
   7. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
   8. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
   9. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 inch by 1-1/2 inches (3.2 mm by 38 mm), with a minimum 6

inch (150 mm) embedment and 2 inch (50 mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

B. Miscellaneous Framing and Supports: Provide steel framing and supports necessary to complete the work and which are not a part of the structural framework, including but not limited to framing and supports for elevator hoistway beams, elevator sills, overhead lobby door frames, sliding doors, countertop and vanities, ceiling hung toilet compartments, and tube framing for partial height walls, CMU partition head supports, mechanical and electrical equipment.
   1. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction. Cut, drill, and tap units to receive hardware, hangers, and similar items.
      a. Fabricate units from slotted channel framing where indicated.
      b. Furnish inserts for units installed after concrete is placed.

   2. Countertop Framing: Custom fabricate countertop and vanity framing, using steel shapes and plates, and cold finished mild steel bars at exposed conditions, for support framing and plywood, to the thicknesses, sizes and shapes shown, and as required to produce work of adequate strength and durability, without objectionable deflections. Use proven details of fabrication, as required, to achieve proper assembly and alignment of the various components of the work.
   3. Galvanize miscellaneous framing and supports at exterior locations; prime paint miscellaneous framing and supports at interior locations.
   4. Steel Pipe Columns: Fabricate steel pipe columns for supporting wood frame construction from steel pipe with steel baseplates and top plates as indicated. Drill or punch baseplates and top plates for anchor and connection bolts and weld to pipe with fillet welds all around. Make welds the same size as pipe wall thickness unless otherwise indicated.
      a. Unless otherwise indicated, fabricate from Schedule 40 steel pipe.
      b. Unless otherwise indicated, provide 1/2 inch (12.7 mm) baseplates with four 5/8 inch (16 mm) anchor bolts and 1/4 inch (6.4 mm) top plates.
      c. Galvanize miscellaneous framing and supports.

2.3 MISCELLANEOUS STEEL TRIM

A. Miscellaneous Steel Trim: Unless otherwise indicated, fabricate units from structural steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
   1. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
      a. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction, spaced not more than 6 inches (150 mm) from each end, 6 inches (150 mm) from corners, and 24 inches (600 mm) o.c.

   2. Cast in Pit Angles and Edge Angles: Provide edge angles, and pit angles, fabricated from angles of size as shown, or required, with welded on stud anchors spaced 24 inches (600 mm) on center. Provide pit and edge angles in as long lengths as possible. Miter and weld corners and provide splice plates for alignment between sections.

   3. Galvanize miscellaneous steel trim.

2.4 FABRICATION TOLERANCES

A. Squareness: 1/8 inch (3mm) maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch (1.5mm).

C. Maximum Misalignment of Adjacent Members: 1/16 inch (1.5mm).

D. Maximum Bow: 1/8 inch (3mm) in 48 inches (1.2m).

E. Maximum Deviation From Plane: 1/16 inch (1.5mm) in 48 inches (1.2m).

2.5 FINISHES

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.6 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

D. Preparation for Shop Priming: Prepare surfaces to comply with **requirements indicated below:**
1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
3. Items Indicated to Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
4. Other Items: SSPC-SP 3, "Power Tool Cleaning."

E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

F. C. Stainless Steel Finishes: Remove tool and die marks and stretch lines or blend into finish.
1. a. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
2. b. Bright, Directional Polish: No. 4 finish.
3. c. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.7 ALUMINUM FINISHES

A. As-Fabricated Finish: AA-M12.

B. Clear Anodic Finish: AAMA 611, Class I, AA-M12C22A41.
1. 1. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 607.1.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
   1. Cast Aluminum: Heavy coat of bituminous paint.
   2. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

3.3 INSTALLING METAL BOLLARDS

A. Fill metal capped bollards solidly with concrete and allow concrete to cure seven days before installing.
   1. Do not fill removable bollards with concrete.

3.1 ERECTION TOLERANCES

A. Maximum Variation from Plumb: 1/4 inch (6mm) per story, noncumulative.

B. Maximum Offset from True Alignment: 1/4 inch (6mm).

C. Maximum Out of Position: 1/4 inch (6mm).

3.2 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop painted surfaces.
   1. Apply by brush or spray to provide a minimum 2.0 mil (0.05 mm) dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 90 00 – Paintings and Coating.

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 05 50 00

SECTION 06 10 00

ROUGH CARPENTRY

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of Division 01 apply to this section.

B. Section Includes:

1. Rough carpentry Work.

2. Installation of glued laminated members, plywood web joists or wood chord metal web joists.

C. Related Sections:

1. Section 01420: Testing and Inspection.

2. Section 03100: Concrete Forms and Accessories.

3. Section 03300: Cast-In-Place Concrete.

4. Section 06200: Finish Carpentry.

5. Section 09250: Gypsum Board.

1.02 SYSTEM DESCRIPTION

A. Regulatory Requirements:

1. Work of this Section shall comply with CBC Chapter 23A.

1.03 QUALITY ASSURANCE

A. Comply with the following as a minimum requirement:

1. Redwood structural and framing lumber shall be graded in accordance with Standard Specifications for Grades of California Redwood Lumber of the Redwood Inspection Service.

2. Douglas fir, larch or hemlock structural and framing lumber shall be graded in accordance with the Standard Grading Rules of the West Coast Lumber Inspection Bureau (WCLIB) or the Western Lumber Grading Rules of the Western Wood Products Association (WWPA).

3. Plywood shall conform to requirements of Product Standard PS 1-95, and shall be grade marked by a recognized grading agency (APA and PTL).

B. Lumber shall bear official grade mark of the association under whose rules it was graded or official grade mark of another recognized grading agency.

C. Structural and framing members 2 inches in thickness and larger shall be air-dried to moisture content not to exceed 19 percent before installation.

D. Each piece of preservative treated lumber shall be identified by the Quality Mark of an approved inspection agency in accordance with CBC Chapter 23A; refer to Section 01420: Testing and Inspection.

E. Lumber showing visible signs of mold growth:

1. Any lumber showing visible signs of mold growth shall be removed from the project site or cleaned as outlined below.

2. The contractor is responsible for all costs associated with cleaning, post-cleaning testing, and reporting for lumber with mold.

a. Lumber that shows visible signs of mold growth prior to, or after installation, shall be cleaned pursuant to USEPA's guidance publication "Mold Remediation in Schools and Commercial Buildings dated March 2001 (EPA 402-K-01.001).

b. A minimum of 10% of the total locations cleaned must be sampled (tape lift method) post cleaning to ensure cleaning effort was successful. Cleaning will be considered acceptable when tape lift sample results evaluated by direct microscopic examination determine that the general abundance of mold is non-detect or rare (normal trapping to 1+).

c. A report prepared by a Certified Industrial Hygienist (CIH) that details the sampling and cleaning results shall be prepared and submitted to the OAR for review and approval of the LAUSD Office of Environmental Health and Safety.

d. Cleaned lumber shall not be installed or enclosed by finish materials until approval of test results. Cleaned lumber must meet moisture content requirements as required elsewhere in this specification prior to installation or application of finishes.

1.04 STORAGE, HANDLING AND PROTECTION

A. The materials supplied as part of the Work of this section shall be protected from exposure to inclement weather before being covered by other Work.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Lumber: Structural and framing lumber shall be of following species and grades:

	INSTALLATION	SPECIES	GRADE
1.	Subfloor, wall sheathing, roof sheathing and ceiling furring	Douglas fir and larch	Construction Board, WCLIB; WWPA
2.	Posts, (5" x 5" and larger, width not more than 2" greater than thickness). WWPA.	Douglas fir and larch	No. 1 Structural Posts and Timbers, WCLIB. No. 1 Post and Timbers,
3.	Beams, girders and truss members (5" and thicker, rectangular, width more than 2" greater than thickness) where exposed as finish members.	Douglas fir and larch	Select Structural Beams and Stringers, WCLIB; WWPA.
4.	Items in subparagraph 3 when concealed. WCLIB No. 1 Beams and Stringers, WWPA.	Douglas fir and larch	No. 1 Structural Beams and Stringers,
5.	Joists, rafters, lintels, posts, mullions and members (2” to 4” thick, 2 to 4 wide)	Douglas fir and larch	Select Structural; Structural Light Framing, WCLIB;
6.	Other lumber (2 to 4 thick, 2" to 4" wide) not specified in subparagraph 5 above.	Douglas fir and larch	Construction Light Framing WCLIB; WWPA
7.	Framing lumber (2" to 4" thick, 5" and wider).	Douglas fir and Larch	No. 1 Structural Joists and Planks, WCLIB; WWPA.
8.	Mudsills and plates in contact with earth.	Douglas fir and Larch treated	Same as subparagraphs 6 and 7.
9.	Sills or plates installed on concrete or masonry surfaces 6" or less above earth or finish grade.	Douglas fir and Larch treated	Same as subparagraphs 6 and 7.
10.	Sills, foundation plates & sleepers installed on concrete, masonry foundations, or installed on concrete slab in direct contact with earth.	Douglas fir and Larch treated	Same as subparagraphs 6 and 7.
11.	Miscellaneous nailing strips and blocks embedded in concrete or masonry.	Douglas fir and Larch treated	Same as subparagraphs 6 and 7.

B. Plywood: Plywood furnished for structural purposes, when exposed outdoors, shall be exterior type plywood. Other plywood furnished for structural purposes shall be exterior type, or Exposure 1.

C. OSB Board or Panels:

1. Oriented strand board or panels shall not be furnished as part of the Work of this section.

D. Preservative Treated Wood:

1. Wood and plywood specified; as treated wood shall be pressure treated wood in accordance with CBC requirements.

2. Seasoning: Treated lumber shall be air seasoned after treatment, for a minimum of 2 weeks before installation. Moisture content shall be 15 percent maximum.

3. Creosote or arsenic is not permitted for treating wood.

4. When treated wood member have been notched, dapped, drilled, or cut, such newly cut surfaces shall be painted with a heavy coat of the same preservative material originally provided for treatment of wood member.

E. Fire Retardant Protection: Wood and plywood specified as fire retardant protected wood shall be treated by approved methods and materials and shall be dried following treatment to a maximum moisture content as follows:

1. Solid sawn lumber 2 inches in thickness or less: 19 percent.

2. Plywood: 15 percent.

F. Plywood Subflooring: Underlayment, Group 1, Exposure 1; of thickness indicated.

G. Mineral Fiber Panels: Asbestos-free, thickness as indicated.

H. Adhesive: Tec, Inc. Sturdi-Bond TA-175, or Top Industrial Inc., Rainbuster 345, elastomeric adhesive conforming to ASTM D 3498 and APA-AFG-01.

PART 3 - EXECUTION

3.01 FASTENINGS

A. Nails and Spikes:

1. Furnish only common wire nails or spikes whenever indicated, specified or required.

2. Whenever necessary to prevent splitting, holes shall be pre-drilled for nails and spikes.

3. Nails in plywood shall not be overdriven.

4. Machine Applied Nailing: Use of machine nailing is subject to a satisfactory Project site demonstration for each Project and approval by the Architect or structural engineer retained by the Architect as an Architect Consultant and DSA. Installation is subject to continued satisfactory performance. Machine nailing is not permitted for 5/16 inch plywood. Do not permit nail heads to penetrate outer ply. Maintain minimum allowable edge distances when installing nails.

B. Lag Screws:

1. When installing lag screws in a wood member, pre-drill hole as required by the CBC.

2. Lag screws, which bear on wood, shall be fitted with standard steel plate washers under head. Lag screws shall be screwed and not driven into place.

C. Bolts:

1. Lumber and timber to be fastened together with bolts shall be clamped together with holes for bolts bored true to line.

2. Bolts shall be fitted with steel plates or standard cut washers under heads and nuts. Bolts shall be tightened when installed and again before completion of the Work of this section.

D. Wood Screws: When installing wood screws, pre-drill holes as required by the CBC.

E. Metal Framing Devices: Framing anchors, joist hangers, ties, and other mechanical fastenings shall be galvanized or furnished with a rust inhibitive coating. Nails and fastenings shall be of the type recommended by manufacturer.

F. Powder Driven Fasteners:

1. Loads shall not exceed 75 pounds unless indicated on the Drawings or when reviewed by the Architect.

2. The operator, tool, and fastener shall perform the following as observed by the Project Inspection agency.

a. Observe installation of first 10 fasteners.

b. Test the first 10 fasteners by performing a pullout test. Load shall be at least twice the design load, or 150 pounds, whichever is greater.

c. Random testing:

1) Load less than 75 lb. - approximately 1 in 10 pins.

2) Load 75 lb. or greater - 1/2 of the pins.

3. Failure of any test will result in testing of all installed pins.

4. Nail heads shall not break the outer skin of sheathing.

5. Non-compliant pins shall be replaced.

3.02 INSTALLATION

A. Stud Walls, Partitions and Furring:

1. Wood stud walls, partitions and vertical furring shall be constructed of members of size and spacing indicated. Provide single treated plate at bottom and double plate at top unless otherwise indicated. Interior, nonbearing non-shear partitions may be framed with a single top plate, installed to provide overlapping at corners and at intersections with other wall and partitions or by metal ties as detailed.

2. Walls and partitions shall be provided with horizontal staggered blocking at least 2 inch nominal thickness and same width as studs, fitted snugly, and nailed into studs. Blocking shall be installed at mid-height of partition or not more than 7 feet on center vertically. Install wood backing on top of top plate wherever necessary for nailing of lath or gypsum board.

3. Walls, partitions and furred spaces shall be provided with 2 inch nominal thickness wood firestops, same width as space to be firestopped, at ceiling line, mid-height of partition and at floor line. Firestops at floor line are not required when floor is concrete. If width of opening is such that more than one piece of lumber is necessary, provide 2 thicknesses of one inch nominal material installed with staggered joints.

4. Firestops shall be installed in stud walls and partitions, including furred spaces, so the maximum dimension of any concealed space is not over 10 feet.

5. Corners, and where wood stud walls and wood vertical furring meet, shall be constructed of triple studs. Openings in stud walls and partitions shall be provided with headers as indicated and a minimum of 2 studs at jambs, one stud of which may be cut to support header in bearing.

6. Where wood and masonry or concrete walls intersect, end stud shall be fastened at top, bottom and mid-height with one 1/2 inch diameter bolt through stud and embedded in masonry or concrete a minimum of 4 inches. Bolts shall be provided with washers under nuts.

7. Sills under bearing, exterior or shear walls shall be bolted to concrete with 5/8 inch diameter x 12 inch long bolts with nuts and washers, spaced not more than 4 feet on center unless noted otherwise. There shall be a bolt within 9 inches of each end of each piece of sill plate. Sills shall be installed and leveled with shims, washers, with nuts tightened to level bearing. Space between sill and concrete shall be dry packed with cement grout.

B. Floor Joists, Roof and Ceiling Framing:

1. Wood joists shall be of the size and spacing indicated, installed with crown edge up, and shall have at least 4 inch bearing at supports. Provide 2 inch solid blocking, cut in

between joists, same depth as joists, at ends and bearings, unless otherwise indicated.

2. Floor joists of more than 4 inches in depth and roof joists of more than 8 inches in depth shall be provided with bridging. Floor joists shall be bridged every 8 feet with solid blocking or metal cross bridging. Roof joists shall be bridged every 10 feet.

3. Joists under and parallel to bearing partitions shall be doubled and nailed or bolted together as detailed. Whenever a partition containing piping runs parallel to floor joists, joists underneath shall be doubled and spaced to permit passage of pipes and blocked with solid blocking spaced at not more than 4 feet intervals.

4. Trimmer and header joists shall be doubled, when span of header exceeds 4 feet. Ends of header joists more than 6 feet long shall be supported by framing anchors or joist hangers unless bearing on a beam, partition, or wall. Tail joists over 12 feet long shall be supported at header by framing anchors or on ledger strips at least 2 x 4.

5. Provide solid blocking between rafters and ceiling joists over partitions and at end supports where indicated.

C. Beams, Girders and Joists:

1. Ends of wood beams, girders and joists which are 2 feet or less above finished outside grade and which abut, but do not enter concrete or masonry walls, as well as wood blocking used in connection with ends of those members shall be treated with wood preservative.

2. Where wood beams, girders and joists enter masonry or concrete walls 2 feet or less above outside wall, metal wall boxes or equivalent moisture barriers shall be provided between wood and masonry or concrete.

D. Subflooring:

1. Floor sheathing: Plywood of thickness and nailing indicated. Install with the face grain across supports, end joints staggered and centered over supports. Provide solid blocking under plywood edges where indicated. In addition to nailing, sheets of plywood flooring shall be secured in place with elastomeric adhesive, installed at beams, joints, perimeter supports and panel edges.

E. Roof and Wall Sheathing:

1. Plywood roof sheathing shall be Structural I, Grade C-D, Exposure 1, thickness as indicated.

2. Where exposed roof sheathing is indicated, area shall be sheathed solid with dressed and center matched, V-jointed boards of sizes indicated. Boards shall be installed perpendicular to supports.

3. Soffits of overhanging eaves, where indicated, shall be boxed-in using Group I, Exterior Type, Grade A-C, plywood, thickness as indicated.

4. Plywood for shear walls shall be Structural I, Grade C-D Exterior Type, thickness as indicated. Install with the long dimension parallel or perpendicular to the supports. Blocking shall be provided behind edges not located over supports. Shear wall construction, nailing, and top and bottom anchorage shall be as indicated.

5. Provide and install metal H-clips of required size, midway between rafters at unsupported edge joints of plywood roof sheathing where rafters are spaced at 24 inches on center. Clips shall be Plyclips, by Timber Fasteners Inc., or Panel Clips by Simpson Co., or equal.

F. Attic Space Partitions and Attic Walkways:

1. Attic space partitions shall be constructed of 2x4 wood members spaced at 2 feet on center maximum with 5/8-inch gypsum board.

2. Doors in attic space partitions shall be self-closing, of the same sheathing material as partition, constructed with 2 battens and a diagonal brace across back.

3. Shear walls passing through attic space shall be sheathed with 5/8 inch gypsum board on each side.

4. Attic walkways shall be constructed of 2x12 planks installed one-inch apart and nailed at each support with three 16d. nails.

G. Furring:

1. Rafters or ceiling joists indicated to be furred for support of materials other than acoustical tile shall be furred with 2x4 wood members installed at right angles to supports, spaced as indicated and nailed in place. Furring shall be aligned, and bottoms shall be leveled by installing wood shims as required, and nailed as indicated.

2. Furring for protective wall padding in gymnasium shall be 1x3 Douglas fir, Construction Boards, S1S1E; applied horizontally to concrete walls at top and bottom of padding panels; and at uniform intermediate spacing not more than 18 inches on center. Stripping shall be shimmed where required, aligned to a true plane, and secured to concrete walls with concrete nails at not more than 18 inches on center.

H. Furring: Where metal furring is not indicated or specified, provide wood furring at points indicated and required for concealing conduit, piping, structural framing or other unfinished materials. Wood furring shall be 2x studs of required width. Vertical members contacting concrete or masonry shall be attached as specified for anchoring interior wood stud partitions.

I. Grounds:

1. Provide and set wood grounds at points where wood trim occurs and work is to be plastered. Grounds at 3/4 inch metal lath shall be 5/8 inch thick, net, 1-1/2 inches wide Douglas fir, S1S. Grounds shall be doubled where trim member exceeds 5 inches width, or wherever indicated. Grounds shall be applied after lath has been installed set plumb, level and true to line.

2. Apply grounds over wood framed surfaces and lath and securely nail to wood backing at each stud or bearing. Grounds applied over steel channel studs and lath shall be securely nailed at each stud or bearing to nail-blocks provided and installed in metal studs.

3. Grounds applied to concrete surfaces shall be securely nailed to woodblocks provided and built into concrete.

J. Nailing Strips and Plates:

1. Provide wood nailing strips, plates and blocking indicated or required. Nailing strips in connection with metal work shall be bolted to metal. Wood nailing blocks for securing grounds shall be built into concrete, or masonry.

2. Nailing schedule shall comply with CBC requirements.

3. Treated wood nailing strips for lightweight insulated concrete roof decks at eaves, ridges, rakes, base of curbs and wherever else indicated, shall be provided and installed. Strips shall be treated Douglas fir, 4 inches (nominal) width by thickness of insulated concrete.

K. Wood Backing: Provide wood backing as indicated and as required to receive plumbing, electrical fixtures and equipment, cabinets, door stop plates and other fixed equipment.

L. Wood Bucks: Furnish and set wood bucks to form openings for doors and other openings in concrete or masonry walls and in steel stud or channel partitions and furring. Bucks shall be Douglas fir, S1S2E, 2 inches (nominal) thickness and of width indicated or required. Bucks in connection with concrete shall be bolted thereto, and bucks in masonry walls shall be attached by means of strap anchors embedded in masonry joints. Bucks in connection with steel studs and metal channels shall be secured with nails or screws spaced not to exceed 24 inches on centers.

M. Bench Tops and Backs: Tops and backs shall be 3/4 inch thick asbestos free board, fabricated to minimize number of joints. Edges shall be neatly cut, smoothly finished and joints accurately fitted and butted. Tops and backs shall be secured with countersunk flathead galvanized wood screws. At bench with steel pan, apply with manufacturer's recommended adhesive. Cut and drill as required for Work to be attached to benches.

3.03 CLEAN UP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

3.04 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION

SECTION 06 16 00 - SHEATHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes: Requirements including but not limited to:
   1. Wall sheathing.
   2. Underlayment.
   3. Sheathing joint and penetration treatment.
   4. Accessories necessary for a complete installation.

1.3 SUBMITTALS

A. Product Data: Technical data for each type of process and factory fabricated product. Indicate component materials and dimensions and include construction and application details.
   1. Include data for wood preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
   2. Include data for fire retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
   3. For fire retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5516.
   4. For products receiving a waterborne treatment, include statement that moisture content of treated materials reduced to levels specified before shipment to Project site.
   5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.4 QUALITY ASSURANCE

A. Fire Test Response Characteristics: For assemblies with fire resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Fire Resistance Ratings: Indicated by design designations from UL *Fire Resistance Directory* or GA-600 *Fire Resistance Design Manual*.

B. Testing Agency Qualifications: For testing agency providing classification marking for fire retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Plywood: DOC PS 1.

B. Oriented Strand Board: DOC PS 2.

C. Thickness: As necessary to comply with requirements specified, but not less than thickness indicated.

D. Factory mark panels to indicate compliance with applicable standard.

2.2 PRESERVATIVE TREATED PLYWOOD:

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.
   1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

C. Application: Treat items indicated on Drawings and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.

2.3 FIRE RETARDANT TREATED PLYWOOD

A. Where fire retardant treated materials are indicated, use materials complying with requirements acceptable to authorities having jurisdiction and with fire test response characteristics specified determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire Retardant Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.
   1. Use treatment that does not promote corrosion of metal fasteners.
   2. Exterior Type: Treated materials shall comply with requirements specified above for fire retardant treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
   3. Design Value Adjustment Factors: Treated lumber plywood shall be tested according ASTM D 5516 and design value adjustment factors shall be calculated according to ASTM D 6305. Span ratings after treatment shall be not less than span ratings specified. For roof sheathing and where high temperature fire retardant treatment is indicated, span ratings for temperatures up to 170 degrees F (76 degrees C) shall be not less than span ratings specified.

C. Kiln dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.

D. Identify fire retardant treated plywood with appropriate classification marking of qualified testing agency.

E. Application: Treat plywood indicated on Drawings and the following:
   1. Roof and wall sheathing within 48 inches (1220 mm) of fire walls.
   2. Subflooring and underlayment for raised platforms.

2.4 WALL SHEATHING

A. Glass Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.
   1. Product: Subject to compliance with requirements, provide products by one of the following:
      a. CertainTeed Corporation; GlasRoc.
      b. G-P Gypsum Corporation; Dens-Glass Gold.
      c. National Gypsum Company; Gold Bond e(2)XP.
      d. United States Gypsum Co.; Securock.
   2. Type and Thickness: Regular, 1/2 inch (13 mm) thick.
   3. Size: 8 by 96 inches (1219 by 2438 mm) for vertical installation.

2.5 SUBFLOORING AND UNDERLAYMENT

A. Plywood Combination Subfloor Underlayment: DOC PS 1, Exterior, Structural I, C-C Plugged single floor panels.
   1. Span Rating: Not less than 20 o.c.
   2. Nominal Thickness: Not less than 1 inch (25 mm).
   3. Edge Detail: Tongue and groove.
   4. Surface Finish: Fully sanded face.

B. Underlayment: Provide underlayment in nominal thickness not less than 1/4 inch (6.4 mm) over smooth subfloors and not less than 3/8 inch (9.5 mm) over board or uneven subfloors.

C. Sound Deadening Board: Class C fire rated, molded, recycled post-consumer paper, cellulose fiber structural panel.
   1. Density: 26 pcf to 28 pcf (416 = 448 kg/cu.m) tested in accordance with ASTM C209.
   2. Tensile Strength: When tested in accordance with ASTM C209”
      a. Parallel: 450 - 700 psi (3100 - 4,830 kPa).
      b. Transverse: 750 - 1--- psi (5.1171 - 6.894 kPa).
   3. Hardness (Janka Ball): 230 lbs (104 kg) tested in accordance with AST D1037.
   4. Water Absorption by Volume: When tested in accordance with ASTM C209.
      a. 2 Hour Immersion: Maximum 7 percent.
   5. Expansion: 50 percent to 90 percent relative humidity, 0.25 percent in accordance with ASTM C209.
   6. Noise Reduction Coefficient (NCR): 0.20.
   7. Flame Spread: Maximum 75 tested in accordance with ASTM E84 Class C.
   8. Thickness: 3/4 inch (19 mm).

2.6 FASTENERS

A. Provide fasteners of size and type indicated that comply with requirements specified for material and manufacture. Provide fasteners with hot dip zinc coating complying with ASTM A 153/A 153M.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening Gypsum Sheathing to Cold Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic polymer or corrosion prote[illegible]g salt spray resistance of more than 800 hours according to ASTM B 117.

NOT USED

1. For steel framing less than 0.0329 inch (0.835 mm) thick, use screws that comply with ASTM C 1002.

2.7 SHEATHING JOINT AND PENETRATION TREATMENT MATERIALS

A. Sealant for Glass Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C 834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass fiber sheathing tape and for covering exposed fasteners.

1. Sheathing Tape: Self adhering glass fiber tape, minimum 2 inches (50 mm) wide, 10 by 10 or 10 by 20 threads/inch (390 by 390 or 390 by 780 threads/m), of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass mat gypsum sheathing and with history of successful in service use.

2.8 MISCELLANEOUS MATERIALS

A. Adhesives for Field Gluing Panels to Framing: Formulation complying with ASTM D 3498 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with Table 2304.10.1 Fastening Schedule in ICC *International Building Code*.

D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.

E. Coordinate wall and roof sheathing installation with flashing and joint sealant installation so materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions. Fasten gypsum sheathing to cold formed metal framing with screws. Install boards with a 3/8 inch (9.5 mm) gap where nonload bearing construction abuts structural elements. Install boards with a 1/4 inch (6.4 mm) gap where they abut masonry or similar materials that retains moisture, to prevent wicking.

B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.

C. Vertical Installation: Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board to each stud.
   1. Space fasteners approximately 7 inches (200 mm) o.c. and set back a minimum of 3/8 inch (9.5 mm) from edges and ends of boards.

D. Seal sheathing joints according to sheathing manufacturer's written instructions. Apply glass fiber sheathing tape to glass mat gypsum sheathing joints and apply and trowel silicone emulsion sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal penetrations and openings.

END OF SECTION 06 16 10

SECTION 06 20 00 FINISH CARPENTRY AND MILLWORK

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Providing all finish carpentry items including, but not limited to:
      a. Finish carpentry.
      b. Millwork and cabinetry.
      c. Solid Surface Countertop.
      d. Plastic laminate.
      e. Casework hardware.
      f. Miscellaneous millwork.
   2. Installation of:
      a. Finish hardware.
      b. Plastic laminate faced wood doors.

B. Related Sections:
   1. Section 06 10 00: Rough Carpentry.
   2. Section 13 34 23: Pre-Engineered Modular Buildings.

C. Reference Standards:
   1. Codes and references:
      A. 2022 California Building Code Section 11B-309.
      B. American Disabilities Act Design Guidelines (ADADG).
   2. American National Standards Institute:
      a. ANSI A156.9 Cabinet Hardware.
      b. ANSI A161.1 Woodwork Testing Standards.
      c. ANSI A208.1 Mat-Formed Wood Particleboard.
   3. Woodwork Institute:
      a. WI North American Architectural Woodwork Standards (current edition).
   4. National Electrical Manufacturers Association:
      a. NEMA LD 3 High Pressure Decorative Laminates.

1.3 SUBMITTALS

A. Product Data:
   1. Manufacturer's specifications and other data needed to prove compliance with specified requirements.
   2. Manufacturer’s preprinted product information for all hardware proposed on the Project.
   3. Manufacturer’s preprinted maintenance instructions for the casework hardware.

B. Shop Drawings:
   1. Indicate size, material, and finish.
   2. Show locations and installation procedures, including hardware, sinks, service fixtures, trim, and other pertinent data for each unit.

C. Certification: Provide manufacturer's certification that casework has been fabricated and installed according to WI "Custom" Grade guidelines or better.

D. Samples: Two (2) each, six-inch by six-inch by 3/4-inch (6" x 6" x 3/4") sample of specified particleboard core with grade stamp for use as verification of installed product.

E. Closeout:
1. Record drawings: Indicate revisions to original Drawings and shop drawings.
2. Manufacturer contact names, addresses, and phone numbers.
3. Finish material schedule: Names and color numbers of laminates and stains.
4. Keys: Provide additional master key for each room and additional locksets totaling one percent (1%) of total Project for attic stock.

1.4 PERFORMANCE REQUIREMENTS

A. Unless otherwise indicated, perform work in accordance with WI "Architectural Woodwork Standards," Custom Grade, except where specification exceeds those standards the more stringent shall govern.

B. Fabricate millwork and cabinetry in accordance with ANSI A161.1, NEMA LD3, and general static load testing performed and certified by an independent testing agency covering the following areas of product performance, with these minimum results:
1. Base cabinet construction/racking test: 800 pounds.
2. Cabinet front joint loading test: 425 pounds.
3. Wall cabinet static load test: 2,000 pounds.
4. Drawer front joint loading test: 600 pounds.
5. Drawer construction/static load test: 750pounds.
6. Cabinet adjustable shelf support device/static load test: 300 pounds.

C. Shelf Loading: Comply with loading/deflection standards of the Composite Panel Association.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a licensee of WI's Certified Compliance Program.

B. Installer Qualifications: Licensee of WI's Certified Compliance Program.

C. Quality Standard:
1. Unless otherwise indicated, comply with WI's "Manual of Millwork" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements:
   a. Before delivery to jobsite, millwork supplier:
      1) Licensees of WI shall issue a certified compliance certificate indicating millwork products being furnished for this Project, and certifying that these products and their installation, will fully meet requirements of grade or grades specified.
      2) Non-licensees of WI shall provide evidence that they have arranged for inspection by WI inspector after completion of fabrication and installation. If conditions are found to be compliant, inspector will issue Compliance Certificate indicating millwork products being furnished for this Project and certifying that these products and their installation will fully meet requirements of grade or grades specified.

b. Each elevation of casework and each countertop shall bear certified compliance label.
c. Cabinet Design Series (CDS): CDS numbers on Drawings indicate typical designs.

D. Certified Seismic Installation Program (CSIP):
1. Before wood or metal stud walls are closed up, provide a written Woodwork Institute CSIP report confirming that acceptable backing is provided in all locations required for casework installation or identifying those locations where backing is missing or improperly located:
a. Backing shall consist of a minimum of either three by six (3 x 6) flat Douglas Fir or 16-gage 50 KSI sheet metal.
2. On completion of installation, provide a Woodwork Institute CSIP Certificate identifying the work covered and certifying that installation meets the requirements of the WI CSIP attachment details and schedules.
3. All fees charged by the Woodwork Institute for their CSIP are the responsibility of the millwork installer and shall be included in their bid.

E. Pre-Installation Conference:
1. See Section 01 31 00: Project Management and Coordination.

1.6 WARRANTY

A. Warranty the work specified herein for five (5) years against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials and workmanship.

B. Defects shall include but not be limited to the following:
1. Rough or difficult operation, or loose or missing parts.
2. Delamination of surfaces.
3. Noticeable deterioration of finish.
4. Warped or misaligned surfaces or telegraphing of subsurface imperfections.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver completed laminate clad casework, countertops, and related products only after wet operations in building are completed. Store in ventilated place, protected from the weather, with relative humidity range of 20 to 50 percent.

B. Protect finished surfaces from soiling and damage during handling and installation with a protective covering.

PART 2 PRODUCTS

2.1 MILLWORK MANUFACTURERS

A. Woodwork Institute listed Accredited Millwork Companies, current roster and shall not preclude Contractor from using other manufacturers, provided they produce equivalent products of the type specified for the scope and size of the Project. Other manufacturers must have experience manufacturing products meeting or exceeding the specifications and must comply with the criteria performance set by the Woodwork Institute or as indicated in Part 1 of this Section and with Division 01 requirements regarding substitutions.

2.2 MILLWORK MATERIALS

A. Plastic Laminate:
   1. High-pressure decorative laminate complying with NEMA LD3, and the following requirements:
      a. Exterior color selection available:
         1) Architect to select from minimum of 250 selections available, including wood grain patterns and solid colors.
         2) Provide five (5) different colors available per project.
         3) If laminate has wood grain, direction of grain shall be vertical on door, end panels, fascia panels, and exposed backs; horizontal on drawer faces, aprons, and top rails.
   2. Laminate grades:
      a. Exposed doors, finished end panels, and other vertical surfaces: GP28 (0.028 inch thick nominal)
      b. Horizontal surfaces other than top: GP28 (0.028 inch thick nominal)
      c. Cabinet liner: CL20 (0.020-inch nominal), white.
      d. Work surfaces and countertops: GP50 (0.050-inch thick nominal) with BK20 (0.20-inch thick) backer sheet.
      e. Backsplash: PH42 (0.042 inch nominal) with nominally balanced backer sheet.
   3. Adhesive: PVA water resistant adhesive. Contact adhesives not permitted.
   4. Pressure fused laminate:
      a. NEMA LD3 VGL, and NEMA LD3 CLS, melamine resin impregnated, 120-gram PSM minimum, thermofused to core under pressure.
      b. Color:
         1) Closed interiors, underside of wall cabinets: White.
         2) Exposed and semi-exposed open cabinets: Match exterior.
      c. Provide balanced construction with same thermofused melamine. Unsurfaced coreboard or simple backers not allowed.

B. Core Material:
   1. Particleboard: ANSI 208.1, Grade M-2-Exterior Glue.
   2. Medium-density fiberboard: ANSI A208.2, Grade MD.
   3. Plywood: Shop sanded, exterior grade veneer cored, hardwood faced, any species, with no defects affecting strength or utility. Overlay plywood not permitted. Plywood allowed at countertops and toe-base only.
   4. Water resistant treated plywood shall have 24-hour thickness swell factor of five percent (5%) or less and 24-hour water absorption factor of ten percent (10%) or less; P.S. 51, Type II or better.
   5. Cabinet components shall be of the following minimum core thicknesses:
      a. Cabinet backs, drawer body, and drawer bottoms: 1/2-inch particleboard.
      b. Door and drawer face, base, wall, and tall cabinet tops and bottoms, cabinet sides, drawer spreaders, cabinet back rear hangstrips, structural dividers, and exposed cabinet backs: 3/4-inch particleboard.
      c. Work surfaces and countertops: Minimum one-inch (1”) particleboard or plywood, except use water resistant treated plywood core at counters with sinks.
      d. Shelves: 3/4-inch particleboard core for 30 inches long or less, one-inch (1”) thick particleboard core for more than 30 inches long; 14-inch deep, unless otherwise noted. Provide vertical dividers for shelves over 36 inches long.
      e. Cabinet toe-base: 3/4-inch plywood. No particleboard within four inches (4”) of floor.

C. Countertops - WI Premium Grade: Where indicated on Drawings.
   1. Solid Surface:
      a. Solid surfacing material thickness: 3/4 inch (19 mm).
      b. Backsplash to match countertops, min 4 inches unless otherwise indicated on Drawings.
      c. Colors, patterns, and finishes: Provide materials and products resulting in colors of

solid surfacing material indicated on Drawings.

2. Quartz countertops:
   d. Seams:
      1) Fabricate countertops without seams to the extent possible. When seams are necessary, fabricate countertops in sections indicated for joining in field, with sealant filled seams 1/16 inch (1.5 mm) in width.
   e. Fittings: Drill countertops in shop for fittings and similar items.
   f. Fabricate with four-inch (4") backsplashes. Sand minor scratches and stains with #400 then #600 sandpaper.
3. Fabrication:
   g. Fabricate tops in one piece, unless otherwise indicated. Comply with solid surfacing material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing:
      1) Fabricate tops with shop applied edges of materials and configuration indicated.
      2) Fabricate tops with loose backsplashes for field application.
   h. Drill holes in countertops for plumbing fittings and soap dispensers in shop.
4. Countertop construction tolerances:
   i. Variation from plumb: For vertical lines and surfaces, do not exceed 1/16 inch in 48 inches (1.5 mm in 1,200 mm).
   j. Variation from level: Do not exceed 1/8 inch in 96 inches (3 mm in 2,400 mm), 1/4 inch (6 mm) maximum.
   k. Variation in joint width: Do not vary joint thickness more than 1/4 of nominal joint width.
   l. Variation in plane at joints (lipping): Do not exceed 1/64-inch (0.4 mm) difference between planes of adjacent units.
   m. Variation in line of edge at joints (lipping): Do not exceed 1/64-inch (0.4-mm) difference between edges of adjacent units, where edge line continues across joint.

D. Countertops and Backsplashes:
   1. Countertops: Where indicated on Drawings; provide countertops with rolled edges in as long as practical continuous lengths. Provide field glued splines at joints. No joints closer than 24 inches either side of sink cutout.
   2. Backsplash: Integral to countertop, four inches (4") high unless otherwise shown. Fabricate with single continuous sheet of laminate from front counter to top of splash with no joints from horizontal to vertical application. No joints shall occur at sink openings.
   3. At exposed countertop end corners, provide one-inch (1") radius, or similar safety treatment.

E. Toe Spaces: Leave toe spaces unfinished for installation of resilient base, unless otherwise shown.

F. End Panels and Filler Strips: Match adjacent case-piece.

G. Edging:
   1. Provide the following in accordance with "Edging Locations:"
      a. Flat edge PVC: 0.020 inch. Solid, high-impact, purified, color-thru, acid resistant, machine-applied with hot melt adhesives.
      b. Three-millimeter (3 mm) PVC: Solid, high-impact, purified, color-thru, acid resistant, pre-lamination primed edging, machine-applied with hot melt adhesives, and machine profiled to 1/8-inch radius.
   2. Edging locations:
      a. Cabinet body edge, including door/drawer front spacer rail: Flat edge PVC, color matched to door/drawer face or as selected.
      b. Forward edge of interior body components, interior dividers, shelf, and top edges of

drawer body: Flat edge PVC to match cabinet interior surface color.

c. Door/drawer-front edging: Three-millimeter (3 mm) PVC, color matched to standard laminates.

2.3 CABINET HARDWARE

A. All hardware shall meet ANSI A156.9 and shall be subject to approval by the Architect. All keying shall match existing master key system and be approved by the Owner:
   1. Acceptable manufacturers:
      a. Knape & Vogt.
      b. As specified herein, provide specified product, or Architect approved equal.

B. Hinges:
   1. Heavy duty, five-knuckle 2-3/4-inch institutional type hinge shall meet ANSI/BHMA A156.9 Grade 1 requirements. Mill ground, hospital tip, Teflon coated tight pin feature with all edges eased. Hinge shall be full wrap around type of tempered steel 0.095 inch thick. Each hinge shall have minimum of nine (9) screws, #7, 5/8-inch FHMS to assure positive door attachment.
   2. One (1) pair per door to 48 inches height. 1-1/2 pair over 48 inches in height. Hinge shall accommodate 13/16 thick laminated door and allow 270-degree swing.
   3. Finish: US26D.

C. Pulls: Wire design, four inches (4”), satin chrome, US26D finish.

D. Sliding Door Hardware:
   1. Frameless 1/4-inch glass sliding doors; double track rolling door assembly.
   2. Framed 13/16-inch thick stile and rail sliding doors; top mounted track with dual roller hangers. Vertical adjustment for accurate alignment.

E. Drawer Slides:
   1. Standard drawers: 3/4 extension, self-closing, white epoxy-coated, lever disconnect, positive in-stop/out-stop, nylon rollers, minimum 100-pound dynamic load rating at full extension.
   2. File drawers: Full extension, three-part progressive opening slide, precision steel ball bearing, minimum 100-pound dynamic load rating at full extension, zinc plated or epoxy coated at manufacturer’s option.
   3. Provide body mounted molded rails for hanging file system for legal or letter size as indicated by manufacturer’s model number. Cutting or machining of drawer body/face not permitted.
   4. Paper storage drawers: Full extension, self-closing, white epoxy-coated, lever disconnect, positive in-stop/out-stop, nylon rollers, minimum 150-pound dynamic load rating at full extension.

F. Catches:
   1. Provide opening resistance in compliance with the Americans with Disabilities Act:
      a. Provide top-mounted magnetic catch for base and wall cabinet door.
      b. Provide two (2) at each tall cabinet door. Catch housing shall be molded in White.

G. Adjustable Shelf Supports:
   1. Dual-pin design with anti-tip-up shelf restraints for both 3/4-inch and one-inch (1”) shelves.
   2. Include keel to retard shelf slide-off, and slot for mechanical attachment of shelf to clip.
   3. Load rating shall be minimum 300 pounds each support without failure.

H. Wardrobe Rod: 1-1/6 inch diameter plated steel rod, with captive sockets.

I. Coat Hooks: Single and double prong, wall mount - satin aluminum.

J. Locks: Five-disk tumbler cam-style with strike. Locks on cabinets in same room keyed alike. Provide two (2) keys per room where doors and drawers are scheduled to receive locks. Dull chrome finish. Lock core shall be removable with a control key, permitting Owner to change lock arrangements without tools.

2.4 SPECIALTY ITEMS

A. Grommets:
1. Approved Product/Manufacturer: Model No. EDP3 manufactured by Doug Mockett & Company, Inc. (basis of design), Manhattan Beach, CA; (800) 523-1269, or Architect approved equal.
2. Size: 2-1/2 inches diameter with “Flip-Top”™ tab in cap.
3. Colors: As selected by Architect from manufacturer’s available colors.
4. Number/location: Where electrical, telephone, and computer data wiring need to pass through tops whether shown or not.

B. Keyboard Drawers (at all knee spaces):
1. Approved product/manufacturer: No. SD-1 as manufactured by Knape & Vogt; or Architect approved equal.

C. Molded Personal Pencil Drawer: High-impact 100 Polystyrene with in-stop, out-stop, and self-closing features. Provide under top mounted 100-pound self-closing slides. Twelve (12) compartment drawer body, and slides, black. Provide where indicated on plans.

D. Mailbox Label Holder: Brass, card size 1/2-inch by 2-3/16 inches. Provide one (1) at each opening.

2.5 SOLID STOCK

A. Moisture Content: Percent of moisture in relation to over-dry weight shall be between eight percent (8%) and 13 percent at time of installation.

B. Natural Finish Hardwood:
1. Occasional knot permitted provided it is tight and smooth.
2. Grain pattern: Rift-cut.
3. Species: WI "Premium" Grade, white oak.

C. Paint Grade Hardwood: Any species, including Parana Pine, except do not use oak, elm, or similar species that have coarse grain.

2.6 MISCELLANEOUS

A. Utility Shelving: WI "Economy" grade.

B. Clothes Rod: 1-1/2 inch diameter smooth wooden dowel by length required, with end supports and fasteners of type recommended to suit application.

C. Telephone/MDF/IDF Board: Provide minimum four foot by eight foot by 3/4 inch (4’ x 8’ x 3/4”) thick plywood for telephone/data punch down blocks and video equipment in accordance with Section 06 10 00: Rough Carpentry. Paint in accordance with Section 09 90 00: Painting and Coating.

2.7 MILLWORK FABRICATION

A. Use the WI Custom Grade woodwork classification unless noted elsewhere complying with referenced quality standard.

B. Fabricate casework, countertops, and related products to dimensions, profiles, and details shown on Drawings. Fabricate casework square, plumb, and true.

C. Detailed Requirements for Cabinet Construction:
   1. Toe-base:
      a. Continuous, ladder type platform with concealed fastening to cabinet bottom, level and secured to floor.
      b. Toe-base at exposed cabinet end panels shall be recessed 1/4 inch from face of finished end for flush installation of finished base material.
      c. No cabinet sides-to-floor will be allowed.
   2. Cabinet top and bottom:
      a. Solid sub-top shall be furnished for all base and tall cabinets.
      b. At cabinets over 36 inches, bottoms and tops shall be mechanically joined by a fixed divider.
      c. Assembly devices shall be concealed on bottom side of wall cabinets.
   3. Cabinet sides:
      a. Doweled, and glued under pressure, or attached with fully concealed interlocking mechanical fasteners to sub-top and bottom.
      b. Drill holes for adjustable shelves 1-1/4 inch on center.
   4. Cabinet backs:
      a. Side bound, captured in grooves, recessed from cabinet rear, and securely fastened at top and bottom.
      b. Hang rails shall be located at rear of cabinet back and fastened to cabinet sides. Provide minimum of two (2) at base, two (2) at wall, and three (3) at tall cabinets as instructed by casework manufacturer.
      c. Provide removable back panels and closure panels for plumbing access at all sink cabinets, and where shown on Drawings.
   5. Exposed end corner and face frame attachment:
      a. Butt joint, glued and finish nailed; or attached with fully concealed interlocked mechanical fasteners.
   6. Door and drawer fronts:
      a. Drawer fronts and hinged doors shall overlay the cabinet body. Maintain a maximum 1/8-inch reveal between pairs of doors, between door and drawer front, or between multiple drawer fronts within the cabinet.
      b. Where indicated, provide stile and rail doors with full 1/4-inch plate glass, hinged or sliding. Exposed lite-opening edges shall be trimmed and glazed with extruded glazing bead.
      c. Where indicated, frameless sliding glass doors shall be 1/4-inch thick plate glass with ground and polished edges. Fit with anodized aluminum shoes and nylon rollers.

D. Drawers:
   1. Drawer fronts: Apply to separate drawer body component sub-front.
   2. Drawer sides: Doweled to receive front and back, glued under pressure, machine squared.
   3. Drawer bottom: Set into front and sides, 1/4-inch deep groove with minimum 3/8-inch standing shoulder, continuously glued. Reinforce drawer bottoms with 1/2 inch by four-inch (4”) front-to-back intermediate underbody stiffeners, mechanically fastened. One (1) at 24 inches, two (2) at 36 inches, and over.
   4. Paper storage drawers: Fitted with full width hood at back.
   5. Hanging file drawers shall be fabricated to accept letter size hanging folders compatible with Pendaflex system.

E. Vertical and Horizontal Dividers: As required by manufacturer for type and style of component.

F. Door/Drawer Front Rail: As required by manufacturer for type and style of component, and hardware placement.

G. Accessibility Requirements - 2022 California Building Code, Section 11B:
   1. The following special requirements shall be met, where specifically indicated on architectural Plans as “accessible” or by general note. Shall be in compliance with California title 24 access:
      a. Countertop height: With or without cabinet below, not to exceed a height of 34 inches above finished floor (A.F.F.), at a surface depth of 24 inches.
      b. Knee space clearance: Minimum 27 inches A.F.F. at apron, and 30 inches clear span width (11B-306.3).
      c. Sink cabinet clearances: In addition to above, upper knee space frontal depth shall be no less than eight inches (8”), and lower toe frontal depth shall be no less than 11 inches, at a point nine inches (9”) A.F.F., and as further described in 11B-306.

H. Typical Desk or Counter Height at Knee Space Locations: 30 inches A.F.F.

PART 3 EXECUTION

3.1 JOB CONDITIONS

A. Environmental Requirements:
   1. Do not install casework until permanent HVAC systems are operating and temperature and humidity have been stabilized for at least one (1) week:
      a. Manufacturer/supplier shall advise Contractor of temperature and humidity requirements for architectural casework installation areas.
      b. After installation, control temperature and humidity to maintain relative humidity between 25 and 55 percent.

B. Conditions: Do not store or install casework in building until concrete, masonry, and drywall/plaster work is dry.

3.2 COORDINATION

A. Coordinate the work of this Section with plumbing work specified in Division 22. Coordinate sink opening construction with sinks specified in Division 22 or as indicated on Drawings.

B. Coordinate location of blocking in walls for installation and support of wall cabinets.

3.3 MILLWORK INSTALLATION

A. Positioning: Place approximately level, plumb, and at right angles to adjacent work.

B. Fitting: Where field cutting or trimming is necessary, perform in a neat, accurate, professional manner without damaging the products and adjacent work.

C. Anchorage: Attach securely so the products will perform to their maximum ability without damage from inadequate fastenings.

D. Fasten tops to frames with concealed clips, screws, and glue.

E. Install simulated wood trim in locations shown on Drawings and in accordance with

manufacturer's instructions.

3.4 EXISTING DOOR LAMINATE RESURFACING

A. Resurfacing procedures shall be in accordance with the recommendations and instructions of the laminate and adhesive manufacturers.

B. Acclimate laminate to the same environment as existing material at least 48 hours. Perform work in well-ventilated area, out of the way of construction dust and traffic to maintain clean adhesion.

C. Clean the substrate with detergent or non-flammable solvent as instructed by laminate manufacturer to remove wax, grease, and polish deposits.

D. Using a belt sander or sander instructed by manufacturer, sand entire surface to remove original finish. Remove sanding dust thoroughly.

E. Coat the sanded surface and back of laminate with a uniform coating of contact adhesive. Allow to dry thoroughly prior to assembling. Assembling wet adhesive lines will trap solvent and may result in poor bonding. Follow the adhesive manufacturer's instructions.

F. Index the laminate with the substrate. Make initial contact by smoothing with palms. Apply pressure using a "J" roller or rotary press. Allow to set as instructed by adhesive manufacturer to achieve full adhesion to maintain warranty. Trim with recommended tools.

G. Apply laminate to door faces and exposed vertical edges. Apply edges before face. Paint top and bottom edges to color match facing.

H. Coordinate hardware and vision lite cutouts with work of other Sections.

3.5 FINISH HARDWARE INSTALLATION

A. The supplier will mark each item of hardware for location. Protect the markings until each item is installed. If any item is delivered to the job not properly marked, return it to the supplier for marking before attempting to install it.

B. Check markings on hardware for proper location. Install and make necessary adjustments for proper working order. Any hardware damaged by improper adjustment or careless abuse will be replaced by Contractor at his expense.

C. Provide clean, properly sized, and accurately placed mortises and drilled holes for all mortise hardware such as locksets and for cylindrical locks where specified only.

D. Fit all surface-applied hardware accurately.

E. After hardware is installed, protect exposed surfaces by use of heavy paper and masking tape and maintain until job completion.

F. Remove all finish hardware except that which is primed for painting before painter's finish is applied. Permanently replace and re-adjust for proper function after painter's finish has dried hard.

G. Millwork contractor shall be responsible for hardware on millwork.

3.6 PLASTIC LAMINATE FACED WOOD DOOR INSTALLATION

A. Protect all doors during handling.

B. Install doors in accordance with manufacturer's instructions.

C. Install and adjust doors for smooth, quite operation.

D. Refer to Section 08 81 00 Door Hardware where applicable.

END OF SECTION 06 20 00

SECTION 06 64 00 – FIBERGLASS REINFORCED PLASTIC PANELING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes: Requirements including but not limited to:
   1. Plastic sheet paneling.
   2. Trim accessories.
   3. Accessories necessary for a complete installation.

1.3 SUBMITTALS

A. Product Data: Technical data including supporting documentation of compliance with surface burning characteristics for FRP and accessories.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Building Code: Comply with applicable requirements of the IBC for interior plastic materials and interior wall finishes.
   2. Surface Burning Characteristics: Determined by testing identical products according to ASTM E 84 by qualified testing agency. Identify products with appropriate markings of applicable testing agency.
      a. Flame Spread Index: 25 or less.
      b. Smoke Developed Index: 450 or less.

B. Source Limitations: Obtain plastic paneling and trim accessories from single manufacturer.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Glass Fiber Reinforced Plastic Paneling: Gelcoat finished, glass fiber reinforced plastic panels complying with ASTM D 5319.
   1. Provide USDA accepted panels for incidental food contact.
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Crane Composites, Inc.
      b. Glasteel.
      c. Marlite.
      d. Nudo Products, Inc.
      e. Parkland Plastics, Inc.

3. Nominal Thickness: Not less than 0.09 inch (2.3 mm).
4. Surface Finish: Molded pebble texture.
5. Color: Selected by Architect from full range of manufacturers colors.

2.2 ACCESSORIES

A. Trim Accessories**:** One piece vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, and caps as needed to conceal edges.
   1. Color: Selected by Architect.

B. Concealed Mounting Splines: Continuous, H-shaped aluminum extrusions designed to fit into grooves routed in edges of factory laminated panels and to be fastened to substrate.

C. Adhesive: Recommended by plastic paneling manufacturer.

D. Sealant: Mildew resistant, single component, neutral curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Section 079200.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the work.

B. Proceed with installation after correcting unsatisfactory conditions.

3.2 PREPARATION

A. Remove wallpaper, vinyl wall covering, loose or soluble paint, and other materials that might interfere with adhesive bond.

B. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.

C. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.

D. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.

E. Lay out paneling before installing. Locate panel joints to provide equal panels at ends of walls not less than half the width of full panels.
   1. Mark plumb lines on substrate at panel joint locations for accurate installation.
   2. Locate panel joints to allow clearance at panel edges according to manufacturer's written instructions.

3.3 INSTALLATION

A. Install plastic paneling according to manufacturer's written instructions.

B. Install panels in a full spread of adhesive.

C. Install panels with fasteners. Layout fastener locations and mark on face of panels so that fasteners are accurately aligned.
   1. Drill oversized fastener holes in panels and center fasteners in holes.
   2. Apply sealant to fastener holes before installing fasteners.

D. Install trim accessories with adhesive and nails or staples. Do not fasten through panels.

E. Fill grooves in trim accessories with sealant before installing panels, and bed inside corner trim in a bead of sealant.

F. Maintain uniform space between panels and wall fixtures. Fill space with sealant.

G. Maintain uniform space between adjacent panels and between panels and floors, ceilings, and fixtures. Fill space with sealant.

H. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION 06 64 00

SECTION 07 21 00 - THERMAL INSULATION

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: Requirements including but not limited to R 30 roof insulation:
   1. Glass fiber blanket.
   2. Lossefill fiberglass Insulation
   3. Accessories necessary for a complete installation.

1.3 RELATED SECTIONS

A. Section 09 21 16 - “Gypsum Board Assemblies.”

B. Section 09 51 00 - “Acoustical Ceilings.”

1.4 SUBMITTALS

A. Product Data: Technical data and installation instructions for each type of insulation product specified.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Fire Performance Characteristics: Identify products with appropriate markings of applicable testing and inspecting organization.
      a. Surface Burning Characteristic: ASTM E 84.
         1) Flame Spread Index: Maximum 25.
         2) Smoke Developed Index: Maximum 450.
      b. Fire Resistance Ratings: ASTM E 119.
      c. Combustion Characteristics: ASTM E 136.
   2. National Fire Prevention Association (NFPA) 255 Test of Surface Burning Characteristics of Building Materials.
   3. Underwriter's Laboratories (UL) 723 Tests for Surface Burning Characteristics of Building Materials.

B. Single Source Responsibility for Insulation Products: Obtain each type of building insulation from single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of work.

C. Environmental Requirements: Manufacture extruded polystyrene with HCFC or other CFC free blowing agents. Mark insulation boards and packages with manufacturer's name and product designation. Unmarked boards and packages will be rejected.
   1. Wherever possible, provide boards from manufacturers who recycle insulation materials.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

1.7 PROJECT CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

B. Sequence work to ensure fireproofing and firestop materials are in place before beginning work.

PART 2 - PRODUCTS

2.1 GLASS FIBER BLANKET

A. Glass Fiber Blanket, Unfaced: ASTM C 665, Type I; with maximum flame spread and smoke developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. CertainTeed Corporation.
      b. Guardian Building Products, Inc.
      c. Johns Manville; a Berkshire Hathaway company.
      d. Knauf Insulation.
      e. Owens Corning.

B. Glass Fiber blown in loose fill insulation
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. CertainTeed Corporation.
      b. Johns Manville; a Berkshire Hathaway company.
      c. Knauf Insulation.
      d. Owens Corning.

2.2 ACCESSORIES

A. Insulation for Miscellaneous Voids:
   1. Glass Fiber Insulation: ASTM C 764, Type II, loose fill; with maximum flame spread and smoke developed indexes of 5, per ASTM E 84.
   2. Spray Polyurethane Foam Insulation: ASTM C 1029, Type II, closed cell, with maximum flame spread and smoke developed indexes of 75 and 450, respectively, per ASTM E 84, and shall conform to all SCAQMD and EPA air quality regulations.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

B. Foam in Place Insulation: Verify that substrates are clean, dry, and free of substances that are harmful to insulation.

1. Priming: Prime substrates where recommended by insulation manufacturer. Apply primer to comply with insulation manufacturer's written instructions. Confine primers to areas to be insulated; do not allow spillage or migration onto adjoining surfaces.

3.2 INSTALLATION

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Batt Insulation: Install insulation that is undamaged, dry, and unsoiled and has not been exposed to ice, rain, or snow at any time.
   1. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
   2. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

C. Framed Construction: Install in cavities formed by framing members according to the following requirements:
   1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
   2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
   3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
   4. For metal framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
   5. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
      a. Glass Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).
      b. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.
   6. Locations:
      a. Provide faced insulation where thermal insulation is required between conditioned spaces and exterior.
      b. Provide unfaced insulation where sound insulation is required between interior spaces.

3.3 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07 21 00

SECTION **07 25 00** –

ROOF **PATCH & REPAIR**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Provide all labor, equipment, and miscellaneous materials to install District purchased and furnished roofing materials over the properly prepared substrate

**ALL products listed in 2.01, D will be furnished by the District. All products not listed in 2.01, D to be furnished by the Contractor. All products listed in 2.1.D will be manufactured by The Garland Company and purchased by Long Beach Unified School District.*

1.2 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. Install new main and overflow drains only where required and as indicated in affected areas.
5. Complete Maintenance of Existing Roof System, including but not limited to:
   a. Seal all coping seams and top of coping.
   b. Seal all penetrations.
   c. Seal all base flashing corners and laps with modified mastic and fiberglass reinforcement.

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.

1.3 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.

1.4 ACTION SUBMITTALS

A. Product Data and MSDS Sheets: For each type of product specified.

1.5 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.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For built-up roofing to include in maintenance manuals.

1.7 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 built-up 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.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.9 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

B. 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.

C. 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.

D. 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.

1.10 WARRANTY

1. Warranty Period: 2 years Contractor Warranty from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL

A. The design is based upon roofing systems engineered and manufactured by The Garland Company:

The Garland Company
3800 East 91st Street
Cleveland, Ohio 44105
Miles Taylor
(310) 367-7655

B. Roofing Contractor to be responsible for all Garland materials in excess of District purchased and furnished amount. District to provide material quantities matching the specified amount below. Any additional Garland material required to complete the project is the responsibility of the roofing contractor. Roofing Contractor responsible for purchasing additional materials required, including all freight and tax charges.

C. Roofing contractor to be at delivery of District purchased roof materials. The District has no responsibility to provide any equipment for handling and / or loading the materials to the Contractor’s trucks. Upon signature of delivery, the roofing contractor assumes full responsibility

for all District purchased roof materials. Any materials lost or stolen are the responsibility of the roofing contractor to replace. Roofing Contractor responsible for freight and tax on the replaced materials. District reserves the right to have the contractor store all materials on non-District property at the expense of the contractor.

D. Maximum quantity of the OFCI materials which will be provided to the Contractor are as follows:

Product	Amount	Unit Size
HPR Torch Base Sheet	TBD	Roll
Stressply IV UV Mineral	TBD	Roll
White Star	TBD	5 Gal
Flashing Bond	TBD	5 Gal
Tuff Stuff Caulking	TBD	Tube
Garla-P-rime VOC	TBD	5 Gal
RMER SS Flat Stock	TBD	4' x 10'

E. The above quantities may or may not be the exact quantities required to complete the project. However, these are the maximum quantities the District will provide to the contractor. It is the responsibility of the contractor to provide any additional materials required to complete the project.

2.2 BASE-SHEET MATERIALS

A. Base Sheet: Fiberglass reinforced SBS modified base sheet used as a base ply for torch applied membranes:

1. HPR Torch Base Sheet
2. Breaking Strength, minimum, ASTM D 146: machine direction, 210 lbf/in (22.5 kN/m);
3. Tear Strength, minimum, ASTM D 4073: machine direction, 250 lbf (880 N); cross machine direction, 200 lbf (880 N).

2.3 ROOFING MEMBRANE PLY SHEETS

A. Ply Sheet: Dual fiberglass reinforced SBS modified membrane for torch applied

1. Stressply IV UV Mineral
2. Breaking Strength, minimum, ASTM D 146: machine direction, 210 lbf/in (22.5 kN/m);
3. Tear Strength, minimum, ASTM D 4073: machine direction, 250 lbf (880 N); cross machine direction, 200 lbf (880 N).

2.4 FLASHING MATERIALS

A. Base Flashing Sheet: Dual fiberglass reinforced SBS modified membrane for torch applied

1. Stressply IV UV Mineral
2. Breaking Strength, minimum, ASTM D 146: machine direction, 210 lbf/in (22.5 kN/m);
3. Tear Strength, minimum, ASTM D 4073: machine direction, 250 lbf (880 N); cross machine direction, 200 lbf (880 N).

B. Primer: Primer capable of providing solid adhesion over monolithic emulsion existing coating.

1. Garla-Prime VOC

C. Asphalt Roofing Mastic:

1. Flashing Bond

2.5 AUXILIARY ROOFING MEMBRANE MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing membrane.

B. Fasteners: Factory-coated steel fasteners and metal plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roofing membrane components to substrate, tested by manufacturer for required pullout strength, and acceptable to roofing system manufacturer.

C. Miscellaneous Accessories: Provide miscellaneous accessories recommended by roofing system manufacturer.

2.6 METAL FLASHINGS

A. Termination bar:

1. Aluminum bar:

a. 1/8 x 1 inch (3.2 x 25.4 mm).

B. Counterflashing and counterflashing extensions:

1. Twenty two (22) gauge galvanized.

C. Piping through roof box:

1. Galvanized Steel: ASTM A 526-85, sheet steel with 1.25 oz./sq. (3.82 g/m^2) Galvwash surfacing.

a. Gauge: Twenty- two (22).

b. Solder: ASTM B32-89, alloy grade 50A. Neutralize flux after soldering.

D. Work shall be in accordance with Architectural Sheet Metal Manual, as issued by Sheet Metal and Air Conditioning Contractors' National Association, Inc., (SMACNA).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Substrate inspection:

1. The Applicator shall inspect the substrate for defects such as excessive surface roughness, contamination, structural inadequacy, or any other condition that will adversely affect the quality of work.

2. The substrate shall be clean, smooth, dry, free of flaws, sharp edges, loose and foreign material, oil and grease. Roofing shall not start until all defects have been corrected.

3. Verify that roof openings and penetrations are in place and braced and that roof drains are securely clamped in place.

4. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that the nailers match thicknesses of insulation.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. Protection:

1. Contractor shall be responsible for protection of property during course of work. Lawns, shrubbery, paved areas, and building shall be protected from damage. Repair damage at no extra cost to Owner.

2. Roofing, flashings, membrane repairs, and insulation shall be installed and sealed in a watertight manner on same day of installation or before arrival of inclement weather.

3. At start of each work day drains within daily work area shall be plugged. Plugs to be removed at end of each work day or before arrival of inclement weather.

4. Preparation work shall be limited to those areas that can be covered with installed roofing material on same day and before arrival of inclement weather.

5. Arrange work sequence to avoid use of newly constructed roofing for storage, walking surface, and equipment movement. Move equipment and ground storage areas as work progresses.

6. Protect building surfaces at set-up areas with tarpaulin. Secure tarpaulin. Spilled or scattered debris shall be cleaned up immediately. Removed material to be disposed from roof as it accumulates.

7. At end of each working day, seal removal areas with water stops along edges to prevent water entry.

8. Provide clean plywood walkways and take other precautions required to prevent tracking of aggregate/debris from existing membrane into new work area where aggregate/debris pieces can be trapped within new roofing membrane. Contractor shall instruct and police workmen to ensure that aggregate/debris is not tracked into new work areas on workmen's shoes or equipment wheels. Discovery of entrapped aggregate/debris within new membrane is sufficient cause for its rejection.

3.3 INSTALLATION, GENERAL

A. Install roofing system in accordance with manufacturer’s recommendations. Have specification and product data sheets on the job site.

B. Start installation of roofing membrane in presence of roofing system manufacturer's technical personnel.

C. Cooperate with testing and inspecting agencies engaged or required to perform services for installing built-up roofing system.

D. Coordinate installing roofing system components so insulation and roofing membrane sheets are not exposed to precipitation or left exposed at the end of the workday or when rain is forecast.

1. Provide tie-offs at end of each day's work to cover exposed roofing membrane sheets and insulation with a course of coated felt set in roofing mastic with joints and edges sealed.

2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.

3. Remove and discard temporary seals before beginning work on adjoining roofing.

E. Details not addressed in specification shall be in accordance with NRCA Manual Plates and recommendations, and the Architectural Sheet Metal Manual, as issued by Sheet Metal and Air Conditioning Contractors' National Association, Inc., (SMACNA).

F. Repair all deficiencies in the roof membrane and flashings including splits, holes, delaminated plies, and open corners with a five-course application of aluminum mastic and fiberglass reinforcement.

3.4 ROOFING MEMBRANE INSTALLATION WHERE ROOFING IS REMOVED

A. Cut a clean edge and prime the roof system around the area removed. Install new deck supports and plywood as necessary to provide a sound substrate for the installation of new roofing.

B. Mechanically fasten a Type II base sheet.

C. Prime the existing roof 1’ in all directions around the area. If a reflective coating is present on the roof field, heat and remove the coating prior to applying the torch flashing.

D. Torch apply a base sheet and extend onto the roof field 9”. Torch apply a cap sheet and extend onto the roof 12”.

3.5 FLASHING

A. General flashing requirements:

1. Base flashing height:

a. Not less than 8 inches without manufacturer’s written approval. If height of base flashing exceeds 24 inches, a batten bar with TF tape must be installed at the midpoint of the sheet. Heat weld a strip of TPA over the batten bar.

B. Curb flashings (new):

1. Curbs must be a minimum of 18” from any other flashing detail.

a. Secure substrate board to metal curbs

2. Install new roofing and Cant strip around curb. Torch apply base sheet and cap sheet.

3. Extend onto the roof field 1’. Prime existing roof field prior to torch application. If a reflective coating is present on the roof field, heat and remove the coating prior to applying the torch flashing.

4. Coat the new flashing area with White Knight Plus WC or equal at 2 gal per sq.

5. Allow the material to dry for 24 hrs.

6. Coat the new flashing area with White Knight Plus WC or equal at 2 gal per sq.
7. Seal all holes, screws, and penetrations on equipment with polyurethane sealant.

C. Wall flashings

1. Adhere cant strip to flashing base in a continuous application of adhesive.
2. Install new roofing. Torch apply base sheet and cap sheet.
3. Extend onto the roof field 1'. Prime existing roof field prior to torch application. If a reflective coating is present on the roof field, heat and remove the coating prior to applying the torch flashing.
4. Coat the new flashing area with White Knight Plus WC or equal at 2 gal per sq.
5. Allow the material to dry for 24 hrs.
6. Coat the new flashing area with White Knight Plus WC or equal at 2 gal per sq.
7. Secure top edge of flashing membrane to vertical substrate with termination bar and butyl tape. Where possible extend over the top of parapet wall.
8. Caulk top of bar with polyurethane sealant.
9. Seal corners and any kick-holes over all flashings with a five-course application of Aluminum mastic and fiberglass reinforcement.
10. Re-secure any loose base flashing using skirt metal counterflashing secured at 8" o.c.

D. Plumbing vents and pipe penetrations

1. Penetrations must be a minimum of 18" from any other flashing detail.
2. Install new lead flashing for the penetration. Set in mastic.
3. Prime the surface of the flashing. Torch apply new cap sheet 1' in all directions of the penetration. If a reflective coating is present on the roof field, heat and remove the coating prior to applying the torch flashing.
4. Coat the new flashing area with White Knight Plus WC or equal at 2 gal per sq.
5. Allow the material to dry for 24 hrs.
6. Coat the new flashing area with White Knight Plus WC or equal at 2 gal per sq.
7. Clamp and caulk the penetration. Install umbrellas to counterflash.
8. Five-course edge the base of the penetration.

E. Coping:

1. Wire brush coping seams, top of coping that terminates on the horizontal, and rusted areas to remove contaminants.
    a. Remove loose or failed self-adhering membrane.
2. Prime the metal.
3. Coat with urethane White Star at 2 gal per sq.

F. Install walkway strips set in solvent free mastic under any new duct supports.

G. New Pipe/conduits sitting on roofs shall be set on and clamped to new rubber blocks with steel channels.

1. Support lines every 10 feet on pipe runs along with support on each side of every union, junction, and direction change.

3.6 FIELD QUALITY CONTROL

A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Owner.

B. Repair or remove and replace components of roofing system where test results or inspections indicate that they do not comply with specified requirements.

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

3.7 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Owner.

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 25 00

SECTION 07 52 00
MODIFIED BITUMEN MEMBRANE ROOFING SYSTEM

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Providing coordination for the entire roofing assembly, including, but not limited to:
   1. Tapered edge strips, cant strips, and wood nailers. (Refer to this Section and Section 06 10 00)
   2. Modified bitumen membrane roofing
   3. Flashings, including sheet metal perimeter edge (fascia) (Refer this Section and Section 07 62 00).
   4. Work incidental to, the complete and proper installation of a watertight modified bitumen membrane roofing system as shown on the drawings or specified herein, and in accordance with all applicable requirements of the Contract Documents.

B. It is the intent of this Section that the Work shall:
   1. Provide a watertight facility;
   2. Conform to all applicable building code requirements and of authorities having jurisdiction.
   3. Section 07 62 00, Roof Related Sheet Metal as part of the Work of this Section; and be performed to obtain a single responsibility total system warranty.

C. Work and materials hereinafter specified shall be best of kind described and, unless specified otherwise, shall be new and of best quality. All roofing materials utilized in performance of each type of work shall be the products of one (1) manufacturer or supplier.

1.2 RELATED WORK

A. All Sections of Work relating to the roofing system, including mechanical, plumbing and electrical items penetrating the roof system.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM)
   1. C920, Standard Specification for Elastomeric Joint Sealants
   2. D41, Standard Specification for Asphalt Primer Used in Roofing, Damproofing, and Waterproofing
   3. D312, Standard Specification for Asphalt Used in Roofing
   4. D2178, Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing
   5. D4479, Standard Specification for Asphalt Roof Coatings - Asbestos-Free
   6. D4586, Standard Specification for Asphalt Roof Cement, Asbestos-Free
   7. D4601, Standard Specification for Asphalt-Coated Glass Fiber Sheet Used in Roofing
   8. D5147, Standard Test Methods for Sampling and Testing Modified Bituminous Sheet Material
   9. D4897, Standard Specification for Asphalt-Coated Glass-Fiber Venting Base Sheet Used in Roofing

10. D6163, Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements

B. ASCE-7 Wind uplifts requirements for geographical area.

C. Federal Specifications (FS)
1. SS-R-620B
2. TT-S-00230C

D. National Roofing Contractors Association (NRCA)
1. Roofing and Waterproofing Manual

E. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA)
1. Architectural Sheet Metal Manual

F. 2022 California Building Code (CBC)

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's printed instructions, schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, product variations, fastener, fastener pattern layout, roof membrane, flashing membrane, adhesives, primers, sealants, and accessories to be used in the Work.

B. Provide asphalt fume recovery plan, for equipment data and proposed loading and heating procedures to limit ground level asphalt fumes.

C. Certifications:
1. Manufacturer's written certification that installer is approved and licensed to install specified roofing system.
2. Manufacturer's affidavit that materials used in Project contain no asbestos.
3. Installer shall submit resume and project experience list for proposed system for Project Manager and job site superintendent.
4. Installer shall submit written certification that there are no undocumented workers being employed by them or by any subcontractor on this project and that all workers on this project are covered by workmen's compensation.
5. Installer shall submit list of all subcontractors with evidence of subcontractor's insurance coverage in compliance with contract requirements.
6. Manufacturer's written certification of approval / acceptance of these specifications and details.
7. Warranty: Submit letter from manufacturer signed by agent authorized to do so, stating acceptance of warranty as specified and detailed.

D. Referenced Standards: Two (2) copies of each referenced standard and retain approved copies at site.

E. Shop Drawings: Furnish from copies of the manufacturer's literature or from copies of NRCA "Roofing and Waterproofing Manual", fourth edition.
1. Furnish for approval any proposed details which differ from those included with this proposal package. All proposed details shall first be approved in writing by roofing manufacturers prior to submitting to Architect for approval.
2. Furnish detail project sequencing, staging, material loading, manpower plans, and project construction schedule for approval.

F. Samples:
1. Submit sample copy of job specific warranty that is to be issued upon project completion.
2. Submit mock-up of all fabricated sheet metal items.
3. Submit 12 inch x 12 inch sample of all types of roof membranes to be installed.

G. Temperature Charts: Bitumen heating devices 24 hour temperature charts.

H. Test Reports: Bitumen manufacturer's test reports relative to the following for each batch of bitumen furnished:
1. Softening Point: ASTM D312.
2. Flashpoint: ASTM D92.
3. Acceptable Bitumen Temperature: As recommended by the bitumen manufacturer and EVT label on containers.
4. Thermometers: Two (2) hand held, "8F" thermometers complying with ASTM E1 to Architect for his checking kettle temperature.

I. Provide site visit reports of manufacturer's visit to the client.

J. Upon Substantial Completion of Work, submit the following to Architect for his submission to Owner:
1. Manufacturer's Warranty: Manufacturer's written warranty as specified.
2. Maintenance Procedures: Three (3) copies of manufacturer's printed instructions for Owner's use regarding care and maintenance of roof.

1.5 PROJECT CONDITIONS

A. Weather Condition Limitations: Proceed with roofing work when existing and forecasted weather conditions permit work to be performed in accordance with manufacturer's recommendations and warranty requirements. Roofing application with moisture present will not be accepted. Do not attempt construction of the roofing system when the reported or calculated dew point are within three (3) degrees of each other

B. Contractor to monitor and record readings every 2 hours or when conditions change. Contractor will have records available for review if required by Owner.

C. Do not allow waste products, petroleum, grease, oil solvents, mineral oil, and other contaminants to come into contact with the roofing system before or during installation. Advise Owner if there is a possibility of his facility emitting such contaminants in the future.

1.6 INSPECTIONS / TESTS

A. The Architect's and Manufacturer's representative shall at all times have access to the job site and work areas. The contractor will provide proper and safe facilities for such access and inspection.
1. Architect Inspections: The Architect will be providing periodic inspections throughout the duration of the project. Architect's Representative shall be required to inspect after completion of each major phase of construction for approval.
2. Manufacturer Inspections:
a. An inspection shall be made by a representative of the material manufacturer a minimum three (3) times monthly during performance of Work to ensure that said project is installed in accordance with the manufacturer's specifications and illustrated details. Written reports by

the manufacturer shall be turned over to the Architect, on each Monday following the prior week.

b. The authorized material manufacturer's field representative shall be responsible for:
   1) Keeping the Architect's representative informed after periodic inspections as to the progress and quality of the work observed.
   2) Calling to the attention of the contractor those matters observed which are considered to be in violation of the contract requirements.
   3) Reporting to the Architect's representative, in writing, any failure or refusal of the contractor to correct unacceptable practices called to his attention.
   4) Confirming, after completion of the work and based on his observation and test, that he has observed no application procedures in conflict with these specifications.

B. Any failure by the Architect's or Manufacturer's Representative to detect, pinpoint, or object to any defect or noncompliance of these specifications of work in progress or completed work shall not relieve the contractor, or reduce, or in any way limit, his responsibility of full performance of work required of him under these specifications.

C. Architect may require tests and inspections as necessary to verify quality of roofing materials and workmanship. Laboratory tests will be performed in accordance with ASTM standard procedures.
   1. Owner will select testing laboratory and will pay for Work required by testing laboratory.
   2. Re-tests for work which fail initial tests or inspections shall be paid by contractor.
   3. **Non compliance with contractor requirements will result in the Architect/Owner to assign full time quality control and will be subject to reimbursement by the construction manager/contractor.**

1.7 QUALITY ASSURANCE

A. General:
   1. Unless otherwise indicated, the materials to be used in this specification are those specified and denote the type, quality, performance, etc. required. All proposals shall be based upon the use of the specified material.
   2. Install materials in accordance with the manufacturer's current published application procedures and the general recommendations of the National Roofing Contractor's Association.
   3. It will be the contractor's responsibility to obtain and/or verify any necessary dimensions by visiting the job site, and the contractor shall be responsible for the correctness of same. Any drawings supplied are for reference only.
   4. Contractor shall plan and conduct the operations of the work so that each section started on one day is complete, details installed and thoroughly protected and in watertight condition before the close of work for that day.
   5. Materials will be securely fastened in place in a watertight, neat and workmanlike manner. All workmen shall be thoroughly experienced in the particular class of work upon which employed. Work shall be performed in accordance with these specifications and shall meet the approval in the field of the Architect.
   6. All waste materials, rubbish, etc., shall be removed from the Owner's premises as accumulated. Rubbish shall be carefully handled to reduce the spread of dust, and shall be deposited at an approved disposal site. At completion, all work areas shall be left broom clean and all contractors' equipment and materials removed from the site.

7. Work and materials hereinafter specified shall be best of kind described and, unless specified otherwise, shall be new and of best quality. All roofing materials utilized in performance of each type of work shall be the products of one manufacturer or supplier. Unless otherwise indicated, the materials to be used in this specification are those specified and denote the type, quality, performance, etc. required. All proposals shall be based upon the use of the specified material.

B. Applicator:
1. Applicator shall have approval by manufacturer of accepted roofing system for application and issuance of specified warranty for a minimum of three (3) years. Proof of license agreement dated at least three years prior to date of bid opening.
2. Applicator shall be an experienced single firm specializing in the type of roofing and sheet metal work specified, with a minimum of five (5) years of previous successful experience on projects similar in size and scope.
3. No subcontracting of sheet metal fabrication or installation will be accepted. Contractor must have a sheet metal shop on the company premises.
4. Applicators shall have a competent Superintendent, who is not actually performing roofing work, on site at all time while work is in progress, with full authority to act on behalf of the Contractor as his agent.
5. All workmen shall be covered by Workmen's Compensation insurance (verify upon request) and thoroughly experienced in the particular class of work upon which employed. Use of undocumented workers will not be tolerated - No Exceptions.

C. Regulatory Requirements:
1. Classification by Underwriters' Laboratories, Inc. as a Class A roof covering.
2. Follow local, state, and federal regulations of safety standards and codes. Refer to applicable building code or International Building Code for roofing system installation requirements and limitations.

D. Laboratory Testing and Samples:
1. Architect may require tests and inspections as necessary to verify quality of roofing materials and workmanship. Laboratory tests will be performed in accordance with ASTM procedures.
2. Owner will select testing laboratory and will pay for Work required by testing laboratory. Contractor shall assume all costs for extraction and patch of all samples.
3. Re-tests for work which fail initial tests or contractor shall pay inspections.
4. Contractor shall correct all deficiencies in accordance with manufacturers recommended procedures at no cost to Owner.

E. Installation:
1. Unless otherwise indicated, the materials to be used in this specification are those specified and denote the type, quality, performance, etc. required. All proposals shall be based upon the use of the specified material.
2. Install materials in accordance with the manufacturer's current published application procedures and the general recommendations of the National Roofing Contractor's Association.
3. It will be the contractor's responsibility to obtain and/or verify any necessary dimensions by visiting the job site, and the contractor shall be responsible for the correctness of it. Any drawings supplied are for reference only.
4. Contractor shall plan and conduct the operations of the work so that each section started on one day is complete, details installed and thoroughly protected and in watertight condition before the close of work for that day.

5. Materials will be securely fastened in place in a watertight, neat and workmanlike manner. All workmen shall be thoroughly experienced in the particular class of work upon which employed. Work shall be performed in accordance with these specifications and shall meet the approval in the field of the Architect.
6. All waste materials, rubbish, etc., shall be removed from the Owner's premises as accumulated. Rubbish shall be carefully handled to reduce the spread of dust, and shall be deposited at an approved disposal site. At completion, all work areas shall be left broom clean and all contractors' equipment and materials removed from the site.

1.8 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements:
1. Classification by Underwriters' Laboratories, Inc. as a Class A roof covering.
2. Exposure C
3. 115 mph Wind Speeds as Basis of Design (per NRCA)
4. Roofing system shall be installed in accordance with ASCE-7-16 wind uplift requirements for geographical location and a 115 MPH 3-second gust wind speed zone with an importance factor of 1.15 based on IBC requirements. Wind-resistance loads listed below have a Reduction Factor of 0.6 and a safety factor of 2.0 incorporated into the calculation.
    1. Zone 1 Field -36.9 psf
    2. Zone 2 Perimeter -48.7 psf
    3. Zone 3 Corner -66.3 psf
5. Follow local, state, and federal regulations of safety standards and codes. Refer to applicable building code or California Building Code for roofing system installation requirements and limitations.

B. Fire Resistance: Meet Underwriter's Laboratory Class "A" fire rating.

C. Contractor shall ensure that base fastener pull out resistance tests on new lightweight insulating concrete fill were performed and approved by Architect and coordinated with Roofing Consultant prior to starting roofing application.

1.9 PRE-INSTALLATION CONFERENCE

A. Roofing Pre-installation Meeting: Before scheduled commencement of modified bitumen roof system installation and associated work meet at project site with installer of each component of associated work, installers of deck or substrate construction to receive roofing work, installers of rooftop units and other work in the around roofing must precede or follow roofing work (including mechanical work if any), LBUSD, Garland Company's representative, and other representatives directly concerned with performance of the Work, including (where applicable), test agencies and governing authorities.

1. Objectives to include:

    a. Review foreseeable methods and procedures related to roofing work.
    b. Tour representative areas of roofing substrates (decks), inspect and discuss condition of substrate, roof drains, curbs, penetrations and other preparatory work performed by other trades.
    c. Review structural loading limitations of deck and inspect deck for loss of flatness and for required attachment.
    d. Review roofing system requirements (drawings, specifications and other contract documents).
    e. Review required submittals both completed and yet to be completed.

f. Review and finalize construction schedule related to roofing work and verify availability of material is, Installer's personnel, equipment and facilities needed to make progress and avoid delays.
g. Review required inspection, testing, certifying and material usage accounting procedures.
h. Review weather and forecasted weather conditions and procedures for coping with unfavorable conditions, including possibility of temporary roofing (if not mandatory requirement).
i. Record (contractor) discussion of the meeting including decisions and agreements (or disagreements) reached and furnish copy of record to each party attending. If substantial disagreements exist at conclusion of conference, determine how disagreements will be resolved and set date for reconvening conference.
j. Review notification procedures for weather or non-working days.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original unopened packaging with all tags and labels intact and legible. Carton and can labels shall indicate appropriate warnings, storage conditions, lot numbers, and usage instructions. Handle and store materials and equipment in such a manner as to avoid damage. Coordinate material storage with school Principal.

B. Manufacturer's packaging and/or roll plastic is not acceptable for exterior storage. Tarpaulin with grommets shall be minimum acceptable for exterior coverings. All materials stored as above shall be minimum of four (4) inches off the substrate, and the tarpaulin tied off with rope.

C. Products liable to degrade as a result of being frozen shall be maintained above 40 degrees F in heated storage.

D. Moisture sensitive products shall be maintained in dry storage areas or properly covered. Roofing insulation and felts must always be covered or stored in a dry area when not being used.

E. The proper storage of materials is the sole responsibility of the contractor. Materials damaged in shipping or storage shall not be used. Wet or damaged roofing materials shall be discarded, removed from job site, and replaced with new materials prior to application.

F. No storage of materials shall be permitted on roof areas other than those materials that are to be installed the same day. Any exception must be in written form. Do not place materials or equipment in such a manner as to overload structure.

1.11 PRECAUTIONS

A. Some of the indicated materials are extremely flammable and/or toxic. Use precautions indicated on can and carton labels.

B. Due caution should be exercised so as not to alter the structural integrity of the deck. When cutting through any deck, care should be taken so as not to damage the deck or any part of the deck, such as post tension cables, etc.

C. If torches are used, Contractor shall maintain a three (3) hour fire watch after completion of torching of each day's work. Provide a 20 lb. fire extinguisher near torch at all times. Use a thermal infrared thermometer to monitor all roof areas.

D. The contractor is to verify the location of all interior ducts, electrical lines, piping, conduit, and/or similar obstructions. The contractor is to perform all work in such a manner as to avoid contact with the above mentioned items.

1.12 WARRANTY

A. Roofing Manufacturer: Warrant the roofing and associated Work for 20 years from date of Substantial Completion as follows:
   1. The warranty shall be a NDL "No Dollar Limit" / no penal sum type, with total replacement cost.
   2. The warranty shall guarantee the entire roof system and associated work against defective materials and workmanship of installation, with NO exclusion for ponding water.
   3. The roof system shall include roof insulation, flashing, metal work, labor, and material shall be guaranteed against failure of workmanship and materials. Repair of the system, including materials and labor, shall be done at no cost to the Owner.

B. Roofing Contractor: Jointly with any subcontractors employed by him, shall guarantee the work required and performed under this contract will be free from defects in workmanship and materials, and that the building will be and remain waterproof for a five (5) year warranty period, after the Architect accepts the work as substantially complete. The warranty shall be in approved notarized written form, to obligate the Contractor, and subcontractors, to make good the requirements of the warranty. The warranty will be held jointly with the Bonding Company for the first two (2) years and the manufacturer for the remaining three (3) years.

C. Make arrangements with the materials manufacturer to provide required inspections for issuance of warranty. Final warranty shall be submitted to Owner at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials shall be manufactured, specified, or accepted in writing by membrane manufacturer issuing the warranty. Proposed materials shall ensure full system warranty from said manufacturer.

B. Samples of all materials used on the project, which are not supplied by the membrane manufacturer, shall be submitted to the membrane manufacturer for written approval prior to starting work.

C. All materials used on the project shall be asbestos free.

2.2 APPROVED PRODUCTS/MANUFACTURERS

A. Unless noted otherwise, specifications are based on products of manufacturers listed below. Manufacturers whose products meet or exceed the specifications, who have

manufactured and installed roof materials and systems of the type specified for a minimum of ten (10) years, and who maintains a single source responsibility for the total roofing system, as described herein, may apply for approval as a substitution in accordance with Division 1 requirements regarding substitutions. The following are pre-approved optional manufacturers.

1. Johns Manville, Denver, Colorado (800) 922-5922
2. Or approved Equal

2.3 ROUGH CARPENTRY

A. All nailers, cants and wooden curbs shall be No. 2 or better treated lumber selected to meet design details and field dimensions and requirements of Section 06 10 00, Rough Carpentry.

2.4 ROOFING SYSTEM ASSEMBLY UNDERLAYMENT DESCRIPTION

A. Base Sheet: Shall be a heavy duty (plus) base sheet or venting base as approved by proposed manufacturer. as needed for wood deck.
   a. Johns Manville Product: PennaPly 28
   b. Or Approved Equal

B. Dry Sheathing Paper: (For use as a slip sheet) Rosin coated, 5 lbs per 100 SF.

2.5 ROOF MEMBRANE ASSEMBLY/SYSTEM DESCRIPTION

A. System Description: A roof membrane assembly consisting of two (2) plies of a prefabricated, reinforced, homogeneous polymer modified asphalt membrane, secured to specified insulation or substrate. The assembly shall possess waterproofing capability, such that a phased roof application, with only the modified bitumen base ply in place, can be achieved for prolonged periods of time without detriment to the watertight integrity of the entire roof system. Contractor option to install using hot asphalt “mopped”, cold adhesive, torched, or any combination – confirm special membrane types with manufacturer. Provide components of the roof membrane assembly meeting the following physical and mechanical requirements.
   1. Modified Bitumen Base Ply: A high performance modified bitumen base ply consisting of a reinforcing mat impregnated and coated with high quality modified bitumen: (Coordinate with manufacturer for special membrane type requirements when installed over insulation.)
      a. Johns Manville Product: APPeX 4S
      b. Or Approved Equal

   2. Modified Bitumen Finish Ply: A high performance modified bitumen finish ply consisting of a reinforcing mat impregnated and coated with high quality modified bitumen, and surfaced with white ceramic granules:
      a. Johns Manville Product: APPEX 4.5 M FR CR G
      b. Or Approved Equal
   3. STRIPPING PLY: Same as Modified Bitumen base ply.

2.6 FLASHING MEMBRANE ASSEMBLY

A. A flashing membrane assembly consisting of two (2) plies of reinforced, polymer modified asphalt membrane with a foil face for protection from ultraviolet degradation:
   1. Backer Sheet:

a. Johns Manville Product: PennaPly 28
b. Or Approved Equal

2. Modified Bitumen Reinforcing Ply:
   a. Johns Mansville Product: APPEX 4.5S
   b. Or Approved Equal
3. Modified Bitumen Flashing Sheet:
   a. Johns Mansville Product: APPEX 4.5 M FR CR G
   b. Or Approved Equal

2.7 ROOFING SHEET METAL

A. Refer to Section 07 62 00, Roof Related Sheet Metal.

2.8 ROOF INSULATION

A. Roofing Insulation:
   1. All insulation shall be approved in writing by the membrane manufacturer as to thickness, type, and manufacturer. All insulation must be approved for the specific application with UL and FM Global approval.
   2. Polyisocyanurate Roof Insulation:(Unless noted Otherwise) Shall comply with ASTM C1289 and Federal Specification (FS) HH-I-1972/Gen and HH-I-1972/2, with a 20 psi minimum compressive strength. Insulation shall be surfaced on both sides with a non-asphaltic fiberglass facers. Thickness shall be 5.2” over all conditioned air space, see drawings for details. Approved product shall be Enrgy 3 as manufactured by Johns Manville or pre-approved equal.
   3. Recover Board (Unless noted otherwise): Glass-Faced Gypsum Roof Board equal to UL rated Type X “Dens Deck Prime” as produced by Georgia-Pacific. Board sizes shall be 48" x 96" x 1/4" or as indicated on drawings for roof assembly. Provide as required by manufacture recommendation primer for Roof System. Approved substitute, SECUROCK by USG.
   4. Tapered Iso. Insulation (Option No. 1 as required): Factory cut 48 inches x 48 inches polyisocyanurate board cut to 1/4 inch per foot slope; thickness varies; ASTM C1289, UL Class A, Factory Mutual Class 1. Approved product shall be Tapered E’NERG’Y 3 manufactured by Johns Manville or pre-approved equal. Provide 1/2 inch recovery board similar to that specified above over tapered polyisocyanurate board insulation if used.
   5. Tapered Perlite Insulation (Option No. 2 as required): Tapered perlite insulation board cut to 1/4 inch per foot slope; thickness varies; conforming to ASTM C728. Approved product shall be Tapered Fesco Board manufactured by Johns Manville or Architect pre-approved equal.
   6. Tapered Edge Strip: 1-1/2 inches to 0 inches (or as required, field verify), 18 inches x 48 inches, install at all expansion joints, curbs, projections, crickets, saddles and base flashings. Approved material shall be Johns Manville Product: Tapered Fesco Edge Strips or approved equal.

2.9 ROOFING ACCESSORIES

A. Roofing Adhesives:
   1. Mopping Asphalt: Asphalt that has been certified for full compliance with the requirements for Low Fume Type IV asphalt listed in Table I, ASTM D312. Each container or bulk shipping ticket shall indicate the equiviscous temperature EVT, the finished blowing temperature, FBT, and the flash point, FP.

a. Approved Product: Trumbull Low Fume asphalt or as required by membrane.

2. Cold Adhesive (if applicable): An asphalt based adhesive formulated especially for adhering polymer modified asphalt roofing membranes and base plies. Adhere shall be UL & FM listed and approved.
   a. Johns Manville Product: MBR Flashing Cement
   b. Or Approved Equal.

B. Bituminous Cutback Materials:
1. Primer: A high flash, quick drying, asphalt solvent blend which meets or exceeds ASTM D41 requirements.
2. Flashing Cement: A heavy-bodied all-weather trowel grade mastic, used as a base for laying-up cold process flashing membrane where fast setting adhesives are required.
3. Approved Product/Manufacturer:
   a. Johns Manville Product: MBR Utility Cement
   b. Or Approved Equal

C. Liquid Applied Modified Bitumen Flashing System,
1. Renew flashings with new Bituminous Flashing System to preserve the life of the details. 3-Course flashing installation at penetrations and protrusions.
2. Warrantable with Roofing System. Include in Roof System Warranty.
3. Fast cure liquid membrane flashing system
4. Flashing drains, penetrations, protrusions, electrical penetrations, low curb details, I-beams and other similar or unconventional conditions.
4. Approved Product/Manufacturer:
   a. Johns Manville Product: PermaFlash
   b. Or Approved Equal

D. Sealants: A single component, high performance, elastomeric sealant conforming to ASTM D232 or ASTM C920 requirements. Acceptable types are as follows:
1. Sonolastic NP 1 manufactured by Sonneborn Building Products; Minneapolis, MN (612) 835-3434

E. Heat-Resistant, High-Temperature Sealant:
1. #736 Heat Resistant Sealant by Dow Corning
2. RTV 382 by Intek Sealants & Adhesives
3. High Temp RTV Silicon #26C by Permatex
4. Superflex Red High Temp RTV by Loctite
5. #1300 Rubber and Gasket Adhesive by Scotch Grip
6. Sikasil GP HT (High Temperature) by Sika (up to 500-degrees, Long-time lead item)

F. Ceramic Granules: No. 11 Grade Specification Ceramic granules of color scheme matching the granule surfacing of the finish ply.

G. Walkpads/Protection Pads: Provide cut sections of granule surfaced polyester reinforced modified bitumen sheet, Johns Manville Product: DynaTred or Approved Equal.
1. Walk pads shall have contrasting granule color from surfacing.
2. Provide walk pads shall be installed at point of roof access, at service points of all roof mounted equipment requiring periodic maintenance.
3. Protection pads shall have rounded corners and extend minimum four (4) inches beyond edge of overlying element.

4. Provide new protection pads under all pipe supports, at HVAC and mechanical access points, in front of all roof top doors and openings.

H. Fasteners:
1. Shall be Factory Mutual approved and as recommended by the manufacturer for the specific application.
2. Fastener for Brick/Masonry: Shall be 1/4 inch x 2 inches, stainless steel nail, one piece unit, flat head, as manufactured by Rawl Zamac Nailin, or approved equal.
3. Fastener for Wood and Insulation (over steel decks): Shall be a minimum #14 Factory Mutual approved fastener, fluorocarbon coated, with CR-10 coating. A minimum 0.200 inch diameter shank and 0.250 inch diameter thread. To be used with Factory Mutual approved, round pressure plates or bar, and having a fluorocarbon CR-10 coating, when subjected to 30 Kesternich cycles (DIN 50018) shows less than ten percent (10%) red rust which surpasses Factory Mutual Approval Standard 4470 as manufactured by Olympic Manufacturing Group, Inc., or pre-approved equal. Stainless Steel 304 when used with ACQ treated lumber.
4. Nails: Stainless Steel ring shank, size as required to suite application, minimum 11 gauge with 3/8 inch diameter head.

2.9 MISCELLANEOUS MATERIALS AND ACCESSORIES

A. Other materials shall be as shown, specified or required and be of the best grade for the proposed use as recommended by the manufacturer.
1. Expansion Joint: As detailed on drawings and outlined in NRCA and SMACNA manuals.
2. Sealant Backer Rod: Provide compressible rod stack of polyethylene foam, polyurethane foam, polyethylene jacketed polyurethane foam, butyl rubber foam, neoprene foam or other flexible, permanent, durable, non-absorptive material as recommended by sealant manufacturer for back-up of and compatibility with sealant. Where used with hot-applied sealant, provide heat-resistant type which will not be deteriorated by sealant application temperature as indicated.
3. Pipe Hangers and Supports: Provide and install all necessary supports for gas lines, conduit, chilled water lines, duct work, condensate lines, etc. Refer to Section 07 72 00, Roof Accessories.
4. Cant Strips: Shall be perlite where used for non-structural purposes. Shall be treated solid wood where used for structural purposes meeting NRCA, Factory Mutual and Underwriters Laboratory guidelines. If solid wood cant is used where insulation exists, cant is to be toe nailed into treated solid wood nailer the same height as insulation. Approved Product/Manufacturer: FesCant Plus by Johns Manville or approved equal.
5. Termination Bar:
   a. Material: Extruded aluminum bar with lip profile.
   b. Size: 0.090 inch thick by 3/4 inch wide with 3/16 inch lip width and a 45 degree lip angle, factory punched 1/4 inch x 3/8 inch oval holes spaced six (6) inches on center.
   c. Approved Product/Manufacturer: Johns Manville or approved equal.
6. Liquid Applied Roof Flashing Material,
   a. Flashing pipe penetrations, low curb details, I-beams and other similar or unconventional conditions.
   b. Approved Product/Manufacturer: PermaFlash Bituminous Flashing System by JohnsManville Or Approved Equal

PART 3 - EXECUTION

3.1 SITE CONDITIONS

A. Environmental Requirements:
   1. Apply roofing in dry weather.
   2. Do not apply roofing when ambient temperature is below 45 degrees F.
   3. Refer to manufacturers recommendations.

3.2 ROOFING AND FLASHING - GENERAL

A. Membrane Application: Install roofing in accordance with roofing system manufacturer's current published instructions and the following requirements. Application of roofing membrane components shall immediately follow installation of insulation as a continuous operation.

B. Examine substrates, areas and conditions with installed present to verify roof openings and penetrations are in place, roof drains are secured in place, blocking, curbs and nailers are properly installed (if not provided by roofing contractor), verify deck substrate is ready to receive installation. Proceed only when installation conditions are satisfactory per manufacturer's recommendations".

C. Contractor to monitor and record readings every 2 hours or when conditions change. Contractor will have records available for review if required by Owner.

D. Prevent materials from entering and clogging roof drains and pipes.

E. Aesthetic Considerations: An aesthetically pleasing overall appearance of the finished roof application is a standard requirement for this Project. Make necessary preparations, utilize recommended application techniques, apply the specified materials and exercise care in ensuring that the finished application is acceptable to the Owner.

F. Application of materials shall be in strict accordance with the manufacturer's *recommendations* except where more stringent requirements are shown or specified. In the instance of a conflict between these specifications and those of the manufacturer, the more stringent specifications shall take precedence.

G. General Installation:
   1. Protect adjacent areas with tarpaulin or other durable materials.
   2. Contractor shall prevent overspray, and be responsible for parking lot areas and/or adjoining areas not part of this contract.
   3. Contractor shall be responsible for sealing, as required, all openings that may allow bitumen migration or drippage, i.e. pitch dams, envelopes, and filler strips.
   4. Prepare surfaces according to manufacturer's or applicator's published instructions. All metal that is to receive bitumen, or come in contact with bitumen or adhesive, shall be first primed with appropriate primer. All Kynar 500 or Hylar 5000 finished metal shall be buff sanded on the surface which is to be primed prior to the application.
   5. Use cleaning materials or primers necessary to render an acceptable surface/substrate.
   6. All surfaces/substrates shall be clean and dry prior to application of materials. Roof deck substrates shall be inspected for moisture in accordance with the manufacturer's recommendations. Architect's representative shall witness

inspection. Roofing installed before inspection by Architect's representative shall be removed to allow inspection.

7. Prior to application of felts and membrane, all foreign matter, gravel, etc., shall be removed from the substrate. Gravel or debris between the substrate and plies is not acceptable.
8. Ambient temperature shall be 45 degrees F and rising.
9. Bitumen kettles or tankers shall have a visible thermometer and thermostatic control to provide positive monitoring of the bitumen temperature when it is heated in accordance with manufacturer's instructions. Kettle shall be kept a minimum of 20 feet away from building, placed so that fumes, odors, and smoke, do not enter building through windows, doors, fresh air vents or similar entrances; are not directed towards freshly painted or anodized surfaces, glass or other glazing materials. Do not place kettle under trees or near vegetation. The assigned kettle man shall remain in close attendance, within 25 feet of ground level, while burners are lit. Kettle lids are to remain closed except for loading. Level of bitumen shall be kept within eight (8) inches from top of kettle. All kettles are to have afterburners installed to reduce fume emissions.
10. Asphalt Bitumen Heating: Heat and apply bitumen in accordance with equiviscous temperature method ("EVT Method") as recommended by the manufacturer. Discard bitumen that has been held at temperature, exceeding finished blowing temperature (FBT) for a period exceeding three hours. Do NOT heat bitumen to a temperature higher than 25 degrees F (14 degrees C) below flash point.
11. Asphalt Temperatures: If the EVT information is not provided, the following asphalt temperature shall be observed. Maximum heating temperature shall be 525 degrees F. Minimum application temperature shall be 400 degrees F.
12. Asphalt Moppings: Ensure that all moppings do not exceed a maximum of 25 pounds per square. Mopping shall be total in coverage, leaving no breaks or voids.
13. Membrane Adhesive Application: Apply cold adhesive in a smooth, even, continuous layer without breaks or voids at the rate of 1-1/2 gallons per square per ply. (The porosity of some substrates may require a heavier application to ensure full adhesion.)
14. Bitumen Consistency: Cutting or alterations of bitumen, primer, and sealants will not be permitted.
15. Circulate bituminous materials, do not allow bituminous materials to stand in luggers for long periods. Use insulated hot transport lines and luggers.
16. Keep kettle lid closed except when adding bitumen.
17. Wrinkles, buckles, kinks, and fishmouths are not acceptable when laying felt and membrane.
18. Dry voids of felt on felt are not acceptable. Fully engage membranes.
19. Primed cant strips shall be installed at the intersection of the deck and the vertical surfaces.
20. All flashings shall be mechanically top-fastened with a termination bar a minimum of six (6) inches on center at the top leading edge, and be a minimum of eight (8) inches in height above the finished membrane height.
21. On slopes greater than one (1) inch in 12 inches, refer to NRCA and/or manufacturer's guidelines for backnailing procedures and follow the more stringent guidelines for all specified materials.
22. Correct all errors in application the same work day they occur, including voids, fishmouths, dry laps or spots, wrinkles, ridges, blisters, bare spots, improper application, physical damage and all work not meeting specifications.
23. Follow manufacturer's recommendation for application of cold adhesive due to slope requirements.

3.3 NAILERS

A. Wooden nailers shall be installed at perimeter edges or drip edges on outside perimeter of building in accordance with FM Global 1-49 securement requirements. All deck penetrations (soil stacks, mechanical curbs, etc.) shall receive wooden nailers stacked minimum 3/4 inch above designed deck thickness.

B. All Construction: Nailers shall be the same height as the finished height of the insulation layer. Nailers shall be anchored to resist a pull-out force of 175 pounds per foot. Fasteners shall be no less than two (2) per nailer, and be spaced at three (3) feet on center maximum to exceed requirements by FM Global 1-49. Provide nailers at all penetrations. Install/Raise all curbs, etc, a minimum of ten (10) inches above roof deck.

3.4 SUBSTRATE PREPARATION

A. Ensure decking to receive insulation is clean (including flutes), dry, even and properly secured.

3.5 APPLICATION OF BASE SHEET

A. Wood deck shall be covered with a base sheet, mechanically fastened as follows:
   1. Install in accordance with manufacturer's current published application instructions and to meet ASCE-7 wind uplift requirements. Fasteners and fastening patterns shall be determined by building height, pull out values from decks (more stringent applies), location and geographical area of the United States. It is the contractor's responsibility to consult current ASCE-7 publications, literature, and bulletins that are in effect at the time of this project. Submit perimeter, field and corner fastening patterns and cite all ASCE-7 data pertaining to the fastening pattern to the Architect for review.
   2. Loose lay rosin sheathing paper in a single layer over all wood deck areas, side lap shall be a minimum 2-inchs and end lap a minimum of 6-inches.
   3. Insulation installed with long-axis parallel with steel deck flutes.
   4. Base sheet laid and secured *perpendicular* to steel deck flutes.
   5. Modified Bitumen Base Sheet Fastening Density:
      a. Zone 1 Field – Fasteners in lap, 18-inches on center.
      b. Zone 2 Perimeter – Fasteners in lap, 12-inches on center.
      c. Zone 3 Corner – Fasteners in lap, 6-inches on center.
   6. #28 Base Sheet Fastener Density:
      a. Zone 1 Field – 2-rows of fasteners, equally spaced between laps, 18-inches on center; and fasteners in lap, 9-inches on center.
      b. Zone 2 Perimeter – 2-rows of fasteners, equally spaced between laps, 9-inches on center; and fasteners in lap, 6-inches on center.
      c. Zone 3 Corner – 3-rows of fasteners, equally spaced between laps, 7-inches on center; and fasteners in lap, 7-inches on center.

A. **APPLICATION OF INSULATION AND COVER BOARD**

B. General:
1. Manufacturer's Instructions: In regard to attachment, the manufacturer's instructions or specifications shall determine the suitability for an application.
2. Precautions: The surface of the insulation must not be ruptured or damaged prior to installation of the roof membrane. Replace damaged boards.
3. Thermal insulation boards shall be laid on the substrate in parallel rows with end joints staggered and butted as close as possible. All joints shall be tight and at the roof perimeter and roof penetrations, insulation shall be cut neatly and fitted to reduce openings to a minimum. All openings 1/4 inch or larger shall be filled with insulation.
4. Insulation shall be tapered or feathered at drains and scuppers to provide proper drainage (if applicable).
5. No more insulation shall be installed than can be covered by the completed roof system by the end of the day or the onset of inclement weather.
6. Tapered insulation and crickets, when specified, shall be placed in accordance with the drawings and/or as required NRCA standards & guidelines.

C. Wood decks; Specified rigid insulation shall be mechanically fastened to the wood deck meeting ASCE-7 wind uplift requirements as dictated by wind zone applicable to location of project. Fasteners and fastening patterns shall be determined by building height, location and geographical area of the United States. It is the contractor's responsibility to consult current publications, literature, and bulletins of current codes and the manufacturer that are in effect at the time of this project.
1. Fastener Density:
   d. Zone 1 Field – 16 fasteners per 4x8 board
   e. Zone 2 Perimeter – 24 fasteners per 4x8 board
   f. Zone 3 Corner – 36 fasteners per 4x8 board

D. For subsequent layer or layers of insulation or specified recovery board, the top surface of the underlying layer of insulation shall be coated with hot asphalt using a minimum of twenty-five pounds (25#) per one hundred (100) square feet of surface, and subsequent layers of insulation shall be applied using offset joints, so that all individual insulation layers joints are offset a minimum of twelve inches (12") both ways with the preceding layer, and immediately walked in place.

3.7 ROOF MEMBRANE INSTALLATION

A. Membrane Application: Install roofing in accordance with roofing system manufacturer's current published instructions and the following requirements. Application of roofing membrane components shall immediately follow application of insulation as a continuous operation.

B. Aesthetic Considerations: An aesthetically pleasing overall appearance of the finished roof application is a standard requirement for this Project. Make necessary preparations, utilize recommended application techniques, apply the specified materials (i.e. granules, metallic powder, etc.) and exercise care in ensuring that the finished application is acceptable to the Owner.

C. Adhesive Application: Apply cold adhesive with a spray equipment or squeegee in a smooth even, continuous layer without breaks or voids at the rate of 1 ½ to 2 gallons per square per ply. (The porosity of some substrates may require a heavier application to ensure full adhesion. Refer to manufacturer’s requirements.)

D. Bitumen Consistency: Cutting or alterations of bitumen, primer, and sealants will not be permitted.

E. Roofing Application: Apply all layers of roofing free of wrinkles, creases or fishmouths. Exert sufficient pressure on the roll during application to ensure prevention of air pockets. Lap seams between the base ply layer and the finish ply layer shall not coincide. Stagger the courses to ensure this.
   1. Apply all layers of roofing so that water flows over or along lap seams, but never against laps.
   2. Fully bond the base ply to the insulation with cold adhesive, torch, or hot asphalt. Each sheet shall have minimum three (3) inch side laps and six (6) inch end laps. Each sheet shall be applied directly behind the adhesive applicator. Stagger end laps a minimum of three (3) feet.
   3. Fully bond the finish ply to the base ply with cold adhesive, torch, or hot asphalt. Each sheet shall have a minimum of three (3) inch side and six (6) end laps. Each sheet shall be applied directly behind the adhesive applicator. Stagger end laps of the finish ply a minimum of three (3) feet. Stagger side laps of the finish ply a minimum of 12 inches from side laps in the underlying base ply. Stagger end laps of the finish ply a minimum of three (3) feet from end laps in the underlying base ply.
   4. Maximum sheet lengths and special fastening of the specified roof membrane system may be required at various slope increments where the roof deck slope exceeds 1/2 inch per foot. The manufacturer shall provide acceptable sheet lengths and the required fastening schedule for all roofing sheet applications to applicable roof slopes.
   5. Lap Treatment: A 20-pound roller shall be used on all side and end laps, following immediately behind application, apply uniform pressure across lap area to achieve a continuous visible bleed out.

F. Granule Embedment: Broadcast mineral granules over all bitumen overruns on the finish ply surface, while the bitumen is still hot, to ensure a monolithic color and adhesion.

3.8 ROOF FLASHING MEMBRANE INSTALLATION

A. Flashing - General:
   1. Flashings shall be installed using the manufacturer's flashing membrane, with length of run not to exceed manufacturer's recommendations.
   2. Wooden nailers or curbs shall be installed at all edges and openings in the roof, mechanically fastened to the deck. The nailers should be of exterior grade wolmanized timber, and of the same thickness as any insulation to be used on the roof.
   3. Cant strips shall be installed at the intersection of the deck and/or all vertical surfaces. Prime all cants.
   4. The roofing field membrane shall extend up over and to the top of cant strips at all vertical intersections or out to the roof's edge.
   5. All substrates receiving flashing membrane shall be clean and primed with asphalt primer, prior to application.
   6. All flashings shall be mechanically fastened with a termination bar a maximum of six (6) inches on center, be a minimum of eight (8) inches above finished roof height (seal top with three (3) coursing), extend a minimum of nine (9) inches onto the field of horizontal roof membrane, and not exceed ten (10) linear feet of run in length.
   7. Install flashing membrane in accordance with drawings and/or material manufacturer's guarantee requirements, whichever is the most stringent.

8. Exert sufficient pressure on the flashing membrane to ensure the prevention of air pockets. This can be accomplished by using a damp, kitchen type sponge mop or a damp, heavy duty cotton nap paint roller.
9. Prime all end laps of the flashing membrane with a uniform coating of the specified asphalt primer and allow to thoroughly dry prior to overlapping of adjoining sheets.
10. Probe laps using a clean, heated roofing trowel and heat fuse dry laps of the flashing membrane to ensure a complete seal.

B. Flashing Application - Masonry Surfaces: Flash masonry parapet walls and curbs using the using the reinforcing sheet and the metal foil flashing membrane. After the base ply has been applied to the top of the cant, fully adhere the reinforcing sheet, utilizing minimum three (3) inch side laps and extend a minimum of three (3) inches onto the base ply surface and three (3) inches up the parapet wall above the cant. After the final roofing ply has been applied to the top of the cant, prepare the surface area that is to receive flashing coverage by torch heating granular surfaces or by application of asphalt primer; allowing primer to dry thoroughly. Torch apply the metal foil-faced flashing into place using three (3) foot widths (cut off the end of roll) always lapping the factory selvage edge. Stagger the laps of the metal foil flashing layer from lap seams in the reinforcing layer. Extend the flashing sheet a minimum of four (4) inches beyond the toe of the cant onto the prepared surface of the finished roof and up the wall to the desired flashing height. Exert pressure on the flashing sheet during application to ensure complete contact with the wall/roof surfaces, preventing air pockets; this can be accomplished by using a damp sponge or shop rag. Check and seal all loose laps and edges. Nail the top edge of the flashing on nine (9) inch centers. (See manufacturer's schematic for visual interpretation.)

C. Flashing Application - Wood Surfaces: Flash wood or plywood parapet walls and curbs using the reinforcing sheet and metal foil flashing membrane. The reinforcing sheet shall have minimum three (3) inch side laps and extend a minimum of three (3) inches onto the base ply surface and to the top of the parapet wall, curb, etc. Nail the reinforcing sheet through the field of the sheet to the vertical wood surface on 12 inch centers from the top of the cant to top of wall curb, etc. Fully adhere the remainder of flashing reinforcing sheet that extends over the cant and roof level. After the finish ply has been applied to the top of the cant, prepare the surface area that is to receive flashing coverage by torch heating granular surfaces or application of asphalt primer; allowing primer to dry thoroughly. Torch apply the metal foil-faced flashing into place using three (3) foot widths (cut off the end of roll) always lapping the factory selvage edge. Extend the flashing sheet a minimum of four (4) inches beyond the toe of the cant onto the prepared surface of the finished roof and up the wall to the desired flashing height. Exert pressure on the flashing sheet during application to ensure complete contact with the wall/roof surfaces, preventing air pockets; this can be accomplished by using a damp sponge or shop rag. Check and seal all loose laps and edges. Nail the top edge of the flashing on nine (9) inch centers. (See manufacturer's schematic for visual interpretation.)

D. Wall and Curb Flashings:
1. The flashing substrate shall be free of all dirt and loose material.
2. The underlayment ply or plies shall be brought to the top of the cant strip and adhered.
3. Starting on the roof at least six (6) inches from the roofside edge of the cant strip, adhere two (2) plies of flashing extending over the cant and up the vertical a minimum of eight (8) inches. Each lap of the ply sheet shall be a minimum of three (3) inches.
4. Starting two (2) inches past the flashing plies, install one (1) ply of SBS flashing membrane in hot asphalt. Laps shall not coincide with previously installed plies.

The top of the SBS flashing shall be one (1) inch past the previously installed plies above the cant strip.

5. Fasten the top edge of the flashings on six (6) inch centers using approved termination bar and fasteners.
6. An NRCA-approved metal counterflashing shall extend down over the flashing a minimum of four (4) inches.
7. Cricket the drainage plane at all curb projections.

E. Perimeter Edge Flashing: Refer to Section 07 62 00.

F. Bleed out of flashing membrane: Broadcast bulk aluminum powder over all bitumen overruns on the flashing membrane surface while the bitumen is still hot to ensure a monolithic surface color. With approval of manufacturer, a premium glossy aluminum paint may be used.

3.9 ROOF SYSTEM INTERFACE WITH RELATED COMPONENTS

A. The following is a list of descriptions for correct installation of components integrated into the roof membrane assembly. In all cases, unless otherwise approved, incorporate flanged components into the system between the application of the base ply and finish ply. The flange must be primed with a uniform coating of approved ASTM D41 asphalt primer and allowed to dry thoroughly; all flanges must be set in approved mastic.

B. Sealant: Caulk all exposed finish ply edges at gravel stops, waste stacks, pitch pans, vent stacks, etc., with a smooth continuous bead of approved sealant.

C. Sheet Metal: Refer to Section 07 62 00, ROOF RELATED SHEET METAL.

D. Liquid Applied (Modified Bitumen) Bituminous Flashing System,

1. Clean all substrate and projections enclosed in modified bitumen flashing in any manner suitable and coated with a primer as approved by the manufacture. Flashing must be installed within 4 hours of primer.
2. Remove any improper flashings. Provide proper roof and wall penetration flashings secured and flashed into roof system. Install proper warrantable penetration flashings.
3. Renew flashings with new Bituminous Flashing System to preserve the life of the details. 3-Course flashing installation at penetrations and protrusions.
4. Install base coat of Bituminous Flashing Cement, roll reinforcement fleece into wet flashing pressing trapped air free with roller. Install top layer of Bituminous Flashing Cement as approved by the manufacture.

E. Penetrations – pipes, sanitary vent stacks, electrical, mechanical, gas, frames, I-Beams

1. Follow penetration details by Manufacturer to accommodate a warrantable installation.
2. Remove any loose sealants
3. Clean penetration with rag and brush.
4. Blow off (pressurized) any dust, loose sealants, and debris.
5. Prime all surfaces.
6. Ensure flashing extends a minimum 8-inches from penetration.
7. Bituminous Flashing Cement must be installed within 4 hours of primer.
8. Renew flashings with new Bituminous Flashing System to preserve the life of the details for a warrantable roof termination.
9. Apply 3-Coursing with Flashing Cement (2-Part) and fleece reinforcing fabric. Use “Finger Cut and Target Sheet” method.

10. Use a trowel to spread the Bituminous Flashing Cement (2-Part) on surfaces. Carry Flashing Cement a minimum 7-inches from penetration. Taper thickness at the pipe for a smooth transition up the pipe. Taper to 0-thickness at roof plane.
11. Install fleece scrim. Ensure scrim is fully embedded and engaged in Bituminous Flashing Cement. Allow to fully cure prior to second coat of Flashing Cement.
12. Install finish coat of Flashing Cement using trowel. Spread a minimum thickness of 1/8-inch to a minimum of 2-inches beyond scrim. Taper up the penetration for a smooth transition from deck to penetration.
13. Minimum thickness is 1/8-inch.
14. Allow Bituminous Flashing Cement to cure for minimum 48 hours.

F. Drains
1. Re-use all existing drains where the drain is in good condition and the plumbing connection to the drain bowl is sound.
2. Replace any damaged drain components.
3. Ensure each drain has the proper and complete hardware.
4. All drains shall have a cast iron screen.
5. All components shall be cleaned to the satisfaction of the onsite owner's representative.
6. Check drains for proper function. Drains and plumbing shall not leak.
7. Prepare surfaces per Bituminous Flashing System Installation Instructions
8. Blow off (pressurized) any dust, loose gravel & asphalt, and debris.
9. Prepare drains for application of new Bituminous Flashing System.
10. Flashing Cement shall encapsulate the entire drain sump.
11. 5-course drains using Bituminous Flashing System with Fleece reinforcing fabric.
12. 5-Course drains by adding an additional layer of Scrim while thinning the Bituminous Flashing Cement application.
13. Prime entire drain sump. ***Do not use a brush, roller, etc. because the application will be too heavy.***
14. Apply Bituminous Flashing Cement base coat over primed area. Spread to a minimum thickness of 1/16-inch. Spread Flashing Cement a minimum 8-inches from drain. Taper edges to 0-thickness.
15. Install target sheet and drain insert**.** Set scrim firmly and uniformly, without voids or wrinkles, into Flashing Cement Application. Fully embed scrim in Flashing Cement.
16. Install intermediate layer of Flashing Cement throughout the entire drain sump. Spread to a minimum thickness of 1/16-inch. Spread Flashing Cement a minimum 8-inches from drain. Taper edges to 0-thickness.
17. Install scrim in entire drains sump. New scrim shall be installed within the entire area of drain sump. Set scrim firmly and uniformly, without voids or wrinkles, into Flashing Cement Application. Fully embed scrim in Flashing Cement.
18. Install top layer of Flashing Cement. Spread to a minimum thickness of 1/16-inch. Spread Flashing Cement a minimum 8-inches from drain. Taper edges to 0-thickness.
19. Allow Flashing Cement to cure for 48 hours.

3.10 FIELD QUALITY CONTROL AND INSPECTIONS

A. Roof cuts shall be performed and repaired at contractor's expense. Cuts shall be made in the areas as indicated by the Architect's representative. Send required roof cuts to roof membrane manufacturer for laboratory examination. Roof cuts required by the Architect's representative shall be furnished to the Architect's representative for testing.

B. Remove not more than one (1) 12 inch x 12 inch cut per 5,000 square feet of roof area or fraction thereof.

C. Field audit will follow criteria outlined in current roof membrane manufacturer's Reference Manual.

D. Repair sampled areas with "feathered in" patch consisting of same number of plies as in the roof specification.

E. Correct deficiencies in roof as prescribed in current roof membrane manufacturer's Reference Manual and as approved by Architect's Representative.

3.12 CLEANING AND PROTECTION

A. Contractor shall keep the job clean and free from all loose materials and foreign matter. Contractor shall take necessary precautions to keep outside walls clean and shall allow no roofing materials to remain on the outside walls.

B. Leave all areas around job site free of trash, debris, roofing materials, equipment, and related items after completion of job.

C. All bituminous or roofing related materials shall be removed from ladders, stairs, railings, and similar parts of the building.

D. Remove bitumen stains from walls, walkways, and driveways.

END OF SECTION 07 52 00

SECTION 07 62 00

ROOF RELATED SHEET METAL

PART 1 PART I - GENERAL

1.1 GENERAL REQUIREMENTS

A. Drawings and Conditions of Contract, including General and Supplementary Conditions and Division 1 Administration Sections, apply to this Division.

1.2 SUMMARY

A. It is the intent of this Section that the Work shall:
   1. Conform to all applicable building code requirements and of authorities having jurisdiction;
   2. Include all shop and field formed sheet metal work shown on drawings, specified or required, including, but not limited to:
      a. Roof penetration sleeves and hood and umbrella counterflashing
      b. Metal counterflashing
      c. Expansion joint
      d. Roof drains
      e. Scuppers
      f. Metal perimeter edge
      g. Gutters, Downspouts, Splash Blocks and Splash Pans
      h. One-way roof moisture relief vents
      i. Metal gravity vents
      j. Metal heat exhaust vents
      k. Sanitary vent pipes
      l. Pipe box
      m. Copings, trim and miscellaneous sheet metal accessories.
   3. Be part of the Work of Section 07 52 19, Modified Bitumen Membrane Roofing System; and
   4. Be performed by a single source contractor.

1.3 RELATED WORK

A. Section 07 52 00 - Modified Bitumen Membrane Roofing System

B. Section 07 72 00 - Roof Accessories

C. All Sections of Work relating to or affecting the roofing system, including mechanical, plumbing and electrical items.

1.4 REFERENCES

A. ASTM International (ASTM)
   1. A525, Standard Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
   2. A526, Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality
   3. A527, Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Lock-Forming Quality
   4. A167, Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

5. B32, Standard Specification for Solder Metal
6. C1107, Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
7. Loss Prevention Data Sheets: I-49, Perimeter Flashing

B. Federal Specifications (FS)
1. QQ-L-201

C. National Association of Architectural Metal Manufacturers (NAAMM)

D. National Roofing Contractors Association (NRCA)
1. Roofing and Waterproofing Manual

E. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA)
1. Architectural Sheet Metal Manual

1.5 SUBMITTALS

A. Product Data:
1. Manufacturer’s specifications and other data needed to prove compliance with specified requirements.
2. Manufacturer’s installation instructions.

B. Shop Drawings: Indicating sizes, configurations, details of attachment to related and adjacent work, materials, and finishes.

C. Samples:
1. Full range of finish colors for Architect's selection.
2. 12 inch long sample of each specified item with approved finish.
3. Provide full size mockup of all shop built assemblies.

1.6 QUALITY ASSURANCE

A. Single Source Responsibility: Fabricator and installer of roof-related flashing and accessories shall be the same as the membrane roof installer.

B. Comply with governing codes and regulations of authorities having jurisdiction.

1.7 INSTALLATION CONFERENCE

A. Refer to Section 01 31 13, Project Coordination.

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver, handle and store materials in accordance with manufacturer's instructions.

B. Handle and store materials and equipment in such a manner as to avoid damage.

C. No storage of materials shall be permitted on roof areas other than those materials that are to be installed the same day. Any exception must be in written form. Do not place materials or equipment in such a manner as to overload structure.

1.9 WARRANTIES

A. Manufacturer's Product Warranty:
1. Manufacturer's standard 20 year Kynar 500 or Hylar 5000 Finish warranty signed by

the manufacturer, with guarantee covering any failure of the fluoropolymer finish during the warranty period.
2. Failure is defined to include, but not be limited to:
   a. Deterioration of finish, such as fading, discoloring, peeling, cracking, corroding, etc.
3. Correction may include repair or replacement of failed product.

B. Roofing Contractor's Warranty:
1. Contractor shall warrant the sheet metal work and related work to be free from defects in workmanship and materials, and that the metal flashings will be and remain watertight, for a period of five (5) years from date of Substantial Completion.
2. Defects shall include, but not be limited to:
   a. Leaking water or bitumen within building or construction.
   b. Becoming loose from substrate.
   c. Loose or missing parts.
   d. Finish failure as defined above.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Manufacturers named within specification are approved for use on the Project providing:
1. their products meet or exceed the specifications;
2. company has a minimum of five (5) years experience manufacturing products of the type specified;
3. products have been tested in conjunction with roofing membrane system as an assembly and as such has obtained the same approval and rating as the roofing membrane system; and
4. products are approved for use by the roofing membrane manufacturer.

B. Substitutions shall be in accordance with Division 1 requirements regarding substitutions.

2.2 SHEET METAL MATERIALS

A. General Requirements: Roofing sheet metal system shall have been tested in conjunction with roofing membrane system as an assembly and have the same approval and rating as the roofing membrane system.

B. Prefinished Aluminum Sheet:
1. Precoated type, aluminum conforming to Fed. Spec. QQ-A-250, ASTM B209.
2. Finish: Kynar 500, color as selected by Architect from manufacturer's standard colors.
3. Thickness: Minimum 0.040 inch, except as otherwise indicated.

C. Sheet Lead:
1. Comply with FS QQ-L-201, Grade B
   a. Four (4) pound minimum for use at roof drains and soil stacks.

D. Stainless Steel: ASTM A167, Type 302/304 Soft Temper, No. 2D finish. Minimum thickness 24 gauge, except as otherwise noted.

2.3 FASTENERS

A. Same metal as flashing/sheet metal or other non-corrosive metal or as noted below.

B. Exposed fasteners shall be self-sealing and gasketed for weathertight installation. (ZAC

type)

C. Match finish of exposed heads with material being fastened.

D. Mechanical Fasteners:
1. Nails: Stainless Steel Ring shank, minimum 1-1/2 inches in length with 1/2 inch diameter head.
2. Washers: Steel washers with bonded rubber sealing gasket.
3. Screws: Self-tapping sheet metal type of stainless steel or compatible with material being fastened, with hooded integral EPDM washers (ZAC type).
4. Rivets: Stainless steel and cadmium plated material, closed end type of sizes recommended by sheet metal manufacturer to suit application.

E. Clips:
1. Continuous Cleat (coping/fascia): Minimum 20 gauge, G-90 galvanized, stainless steel, or aluminum. Match material of coping/fascia and provide one (1) gauge heavier.

2.4 RELATED MATERIALS

A. Solder: ASTM B32, alloy grade 58, 50 percent tin, 50 percent lead.

B. Flux:
1. Phosphoric acid type, manufacturer's standard.
a. For Use with Steel or Copper: Rosin flux
b. For Use with Stainless Steel: Acid-chloride type flux, except use rosin flux over tinned surfaces.

C. Underlayment:
1. 48 mil minimum, non-reinforced, homogeneous, waterproof, impermeable elastomeric sheeting manufactured by Nervastral, Inc. or Lexsuco.

D. Adhesives: Type recommended by flashing sheet manufacturer seaming and adhesive application of flashing sheet to ensure adhesion and watertightness.

E. Metal Accessories: Sheet metal clips, straps, anchoring devices, clamps and similar accessories required for the complete installation of work, matching or compatible with material being installed, non-corrosive, size and gauge recommended by installer to suit application and performance.

F. Sealant:
1. Type A:
a. Type: One-part, non-sag, moisture-curing polyurethane sealant.
b. Approved Products/Manufacturers: "Chem-Calk 900" manufactured by Bostik Construction Products Division, "Vulkem 921" manufactured by Mameco International, Inc., "Dynatrol I" manufactured by Pecora Corporation, "NP 1" manufactured by Sonneborn Building Products, or approved equal.
2. Type B:
a. Type: One-part, neutral-curing, medium-modulus silicone sealant for sealing metal to metal surfaces, i.e. metal edge, cover plates, etc.
b. Approved Products/Manufacturers: "Chem-Calk 1200" manufactured by Bostik Construction Products Division, "795 Silicone Building Sealant" manufactured by Dow Corning Corporation, "895 Silicone" manufactured by Pecora Corporation, "Omniseal" manufactured by Sonneborn Building Products, "Spectrem 2" manufactured by Tremco Incorporated, or approved equal.

G. Grout - Pitch Pans:
   1. Type: Quick-setting, non-shrink, non-metallic, high strength formula complying with ASTM C1107.
   2. Approved Products/Manufacturers: “Sure Grip High Performance Grout” manufactured by Dayton Superior Corporation, “Premier Quick-Trim” manufactured by L & M Construction Chemicals, Inc., “Masterflow” manufactured by Master Builders, Inc., “Sonnogrout 10K” manufactured by Sonneborn Building Products, or approved equal.

H. Pitch Pan Filler:
   1. Type: Pourable polyurethane sealer, approved by roofing system manufacturer.
   2. Approved Products/Manufacturers: “Quick Pitch Sealer” manufactured by U.S. Intec, “SPM Pourable Sealer” manufactured by Johns Manville, or approved equal.

I. Termination Bar:
   1. Material: Extruded aluminum bar with flat profile.
   2. Size: 1/8 inch thick by one (1) inch wide with factory punched 1/4 inch x 3/8 inch oval holes spaced six (6) inches on center.
   3. Approved Product/Manufacturer: “TB 125” manufactured by TruFast Corp., or approved equal.

J. Pipe Hangers and Supports: Refer to Section 07 72 00, Roof Accessories.

K. Splash Blocks: Concrete type, of size and profiles indicated; minimum 3,000 psi compressive strength at 28 days, with minimum five (5) percent air entrainment. Use at locations where roof drainage dumps on ground.

L. Splash Pans: 22 gauge stainless steel, of size and profiles indicated. Use at locations where roof drainage discharges over adjoining, lower roof level(s).

M. One-Way Moisture Relief Vents: Shall be fabricated from spun aluminum as recommended by Roofing Manufacturer.

2.5 FABRICATION

A. Except as otherwise indicated, fabricate work in accordance with SMACNA Architectural Sheet Metal Manual and other recognized industry practices and reviewed shop drawings. Form all flashings, receivers and counterflashings in accordance with standards set forth in the NRCA roofing manual and SMACNA.

B. Comply with manufacturer's installation instructions and recommendations.

C. Unless noted otherwise, fabricate perimeter edge/fascia, scuppers, gutters, downspouts, copings, counterflashings, wind clips, and trim from pre-finished aluminum sheet steel.

D. Shop fabricate work to greatest extent possible. Fabricate inside and outside corners for metal edges, counterflashing, and coping caps of equal length – minimum 2 foot lengths.

E. Fabricate items to size and dimensions as indicated on the drawings. Limit single-piece lengths to ten (10) feet.

F. Fabricate for waterproof and weather-resistant performance; with expansion provisions for running work sufficient to permanently prevent leakage, damage or deterioration of the work.

G. Integrate flashing in a manner consistent with detailing. Form work to fit substrates.

H. Make angle bends and folds for interlocking metal with full regard for expansion and contraction to avoid buckling or fullness in metal after installation.

I. Fabricate items with straight lines, sharp angles, smooth curves, and true levels. Avoid tool marks, buckling, and oil canning.

J. Fold back edges on concealed side of exposed edge to form hem.

K. Unless noted otherwise, lap joints minimum one (1) inch. Rivet and solder joints on parts that are to be permanently and rigidly assembled.

L. Seams:
1. Wherever possible, fabricate non-moving seams in sheet metal with flat-lock seams and end joints.
2. Pre-finished Galvanized Steel: Seal pre-finished metal seams with rivets and silicone sealant.
3. Metal Other than Aluminum: Tin edges to be seamed, form seams, and solder.

M. On Kynar 500 or Hylar 5000 pre-finished metal, surface sand metal flanges prior to applying any primers. Prime all metal in contact with bituminous material.

N. Backpaint all concealed metal surfaces with bituminous paint where expected to be in contact with cementitious materials or dissimilar metals.

O. Expansion Provisions: Where lapped or bayonet type expansion provisions in work cannot be used or would not be sufficiently waterproof or weatherproof, form expansion joints of intermeshing hooked flanges, not less than one (1) inch deep filled with mastic sealant concealed within joints.

2.6 FABRICATED ITEMS

A. Metal Flashings: (Minimum ten (10') foot lengths)
1. Through wall Receiver Tray: Minimum 24 gauge stainless steel, through wall receivers shall not extend past the face of the exterior veneer more than ¾".
2. Counterflashing: Minimum 24 gauge stainless steel.

B. Wind Clips: Minimum 24 gauge stainless steel (or match material of counterflashing), one (1) inch wide by length to engage counterflashing a minimum of 1/2 inch. To be installed at all wall flashings and at curb flashing lengths longer than 5 feet.

C. Roof Penetrations:
1. Umbrella Counterflashing: Two-piece construction of minimum 24 gauge stainless steel, fabricated in accordance with drawings or project requirements.
2. Pitch Pans:
a. 24 gauge stainless steel.
b. Fabricate to provide installed minimum clear inside perimeter dimension of two (2) inches on each side of penetrating element.
c. Fabricate pans to at least six (6) inches above the finished roof membrane and with 1/4 inch hem at top edge and with four (4) inch flanges. Round all corners of flange.
d. Fabricate metal bonnets for all pans, NO EXCEPTIONS. Fabricate bonnets with metal compatible with metal to which bonnet is to be attached. On beams and other steel, weld in place bonnets fabricated from 1/4 inch steel plate. Draw band bonnets fabricated from 22 gauge stainless steel may be used on circular projections.

D. Metal Edge:
   1. Minimum 0.040 inch thick pre-finished aluminum formed in maximum ten (10) foot lengths, with six (6) inch wide cover plates of same profile, four (4) inch flange, maximum seven (7) inch fascia, 3/4 inch gravel stop.
   2. Provide expansion slip joints at maximum 20 feet on center.
   3. Shop fabricate all interior and exterior corners. Fabricate exterior corners with 18 inch minimum to four (4) foot maximum legs. Lap, rivet, and seal prior to delivery to jobsite.
   4. Fabricate to sizes and dimensions as indicated on drawings with a minimum one (1) inch coverage past top of wall. Refer to SMACNA Fig. 2-5A.
   5. Provide mock-up for Architect's approval prior to fabrication.

E. Continuous Cleats: Continuous strips, same material and profile, minimum one gauge heavier of item which cleats attach.

F. Vent Hoods, Sleeves, Penetration Flashings, and Accessories: Minimum 24 gauge stainless steel, or as shown or directed otherwise.

G. Angle Termination Bar: Aluminum pressure bar 1/8 inch x one (1) inch.

H. Vent Pipe Flashing: Four (4) pound lead. Provide proper size to fold down inside of pipe a minimum of one (1) inch.

I. Roof Drain Flashing: Four (4) pound lead, minimum 30 inches by 30 inches.

J. Coping:
   1. Minimum 0.040 inch thick pre-finished aluminum, with six (6) inch wide cover plates of same profile.
   2. Fabricate as outlined in SMACNA; Refer to Figure 3-4 A.
   3. Provide tapered substrate to slope to one (1) side, and cover with waterproof membrane.
   4. Install with continuous cleat one (1) side and fasten other side.

K. Gutters/Downspouts/Collector Heads:
   1. Gutters and Downspouts: Minimum 0.040 inch thick pre-finished aluminum formed in maximum ten (10) foot lengths, with six (6) inch wide cover plates. Minimum five (5) inch by six (6) inch box gutter (verify size meets rainfall data per SMACNA).
   2. Gutter/Downspout Straps: Minimum 0.040 inch thick pre-finished (match color) aluminum. Hem both sides.
   3. Gutter Supports: Minimum 0.040 inch thick pre-finished (match color) aluminum hemmed around 1/8 inch galvanized bent steel bracket.
   4. Gutter Screen: Stainless steel 1/4 inch diamond wire screen enclosed in a pre-finished frame.
   5. Collector Heads: Minimum 0.040 inch thick pre-finished (match color) aluminum. As outlined in SMACNA; Refer to Figure 1-25F and Figure 1-28 with alternate Section A-A.

L. Pipe Box Cover: 24 gauge stainless steel.

M. Heat Exhaust Curbs and Hoods: 22 gauge stainless steel.

N. Expansion Joint Cover: Minimum 24 gauge stainless steel (Provide pre-finished metal at perimeter edge end termination.)

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify substrates are smooth and clean to extent required to perform sheet metal work.

B. Verify roof openings, curbs, pipes, sleeves, ducts or vents through roof are solidly set in place.

C. Verify that reglets, nailers, cants, and blocking to receive sheet metal are in place and free of concrete and soil.

D. Do not start work until conditions are satisfactory.

3.2 PREPARATION

A. Field measure site conditions prior to fabrication work.

B. Install starter and edge strips and cleats before starting installation.

3.3 INSTALLATION

A. Install sheet metal with lines, arises, and angles sharp and true, and plane surfaces free from objectionable wave, warp, or buckle. Exposed edges of sheet metal shall be folded back to form 1/4 inch hem on concealed side from view. Finished work shall be free from water retention and leakage under all weather conditions. Pre-fabricated corners or transitions are required at changes in direction, elevation, or plane and at intersections. Locate field joints not less than 12 inches, nor more than three (3) feet from actual corner. Laps shall be one (1) inch, riveted and soldered at following locations:
   1. Pre-fabricated corners;
   2. transitions;
   3. changes in direction, elevation, and plane; and
   4. at intersections.

B. Anchor units of work securely in place to prevent damage or distortion from wind or buckling. Provide for thermal expansion of metal units; conceal fasteners wherever possible; and set units true to line and level as indicated. Install work with laps, joints, and seams which are permanently watertight and weatherproof.

C. Install fabricated sheet metal items in accordance with manufacturer's installation instructions and recommendations and with SMACNA Architectural Sheet Metal Manual.

D. Separations: Provide for separation of metal from dissimilar metal or corrosive substrates by coating concealed surfaces with zinc chromate, bituminous coating, or other permanent separation at locations of contact as recommended by manufacturer or fabricator. Do not use materials which are incompatible with roofing system.

E. Continuous Cleat: At exposed edges of perimeter edge, fascias, cap flashings, and where required, attach continuous cleat at six (6) inches on center with appropriate fasteners.

F. Gravel Guard/Fascia:
   1. Install with expansion joints 10 feet o.c., 1/2 inch expansion leeway, with cover plate.
   2. Set in asphalt mastic and fasten into nailer at 3 inches o.c. staggered.
   3. Buff sand Kynar surface of flange and prime.
   4. Strip in flange with specified stripping plies set in hot bitumen extending 3 inches from outer edge of flange to at least 3 inches inward towards gravel stop. Provide finish stripping ply of modified bitumen base ply in hot bitumen extending 6 inches from the

outer edge of the flange and butt base of gravel stop.

G. Counterflashing:
1. Do not use surface mount counterflashing except as noted in drawings.
2. Set in through wall with receiver and spring lock counterflashing, as detailed in drawings and to NRCA roofing manual, SMACNA standards.
3. Coordinate installation of through-wall flashing with the masonry contractor.
4. Seal through-wall in conjunction with masonry wall waterproofing.
5. Install wind clips 30 inches o.c. at all counterflashing over five (5) feet in length.

H. Pitch Pans, Metal Flanges:
1. Apply mastic under pitch pan or metal flashing flange at least 1/2 pound per linear foot.
2. Prime all metal flanges with asphalt primer prior to flashing installation.
3. Clean all projections enclosed in pitch pans in any manner suitable and coated with a rust inhibitive coating as approved by the Architect. Coating shall be allowed to dry prior to pitch pan fill.
4. Fill base of pitch pans with grout or cementitious binder and allow to cure.
5. Top Finish Fill: Self-leveling, one-part urethane; at least two (2) inches to top of pitch pan sides.
6. Strip in pitch pan flanges with two strips of specified stripping plies set in hot bitumen extending three (3) inches from the outer edge of the flange to at least three (3) inches inward toward base of pitch pan. Provide finish stripping ply of SBS modified bitumen membrane in hot bitumen extending six (6) inches from the outer edge of the flange and butt to base of pitch pan.

I. Sanitary Vent Stacks:
1. Prime top and bottom flanges of lead flashing sleeve. Set flange in uniform troweling of plastic roof cement. Prime top side of flange to receive strip-in membrane.
2. Fold lead sleeve down inside of pipe a minimum of one (1) inch. Apply a continuous bead of sealant on inside of pipe prior to folding lead sleeve.

J. Roof Drains:
1. After membrane installation, prime bottom of lead flashing sheet and set in uniform bed of plastic roof cement at specified locations.
2. Extend lead flashing into drain bowl or pipe a minimum of two (2) inches and over top of piping/bowl connection, if possible. Apply a continuous bead of specified Type A sealant, at intersection of pipe and drain bowl.
3. If drain bowl and pipe connection is contaminated with bituminous material, strip-in area with three (3) coursing of plastic roof cement and fabric.
4. Prime top of lead flashing sheet to receive strip-in membrane.

K. Gutters/Downspouts:
1. Install gutters as detailed.
2. Install downspouts plumb and level, attached to columns or wall with straps located at top and bottom of downspout and maximum ten (10) feet on center.
3. Install splash pad or block under discharge port of downspouts. Install splash pan over a protection (walkway) pad for downspouts located at roof level.
4. End Caps, Downspout Outlets, Gutter and Downspout Straps, Support Brackets and joint fasteners to be manufactured to suit profile and dimension of gutter and downspout.
5. Install all anchoring devices as outlined in SMACNA.
6. Expansion Joints: Lap or Butt type per SMACNA, locate every 50 linear feet.

L. Expansion Joint:
1. Construct wood curbs as shown on drawings and as outlined in the NRCA and

SMACNA Manuals.

2. Install underlayment, form envelope, and secure underlayment to curb. Fill envelope with compressible insulation.
3. Securely fasten expansion joint cover to curb with grommetted fasteners spaced six (6) inches on center.
4. Taper expansion joint down at the metal edge.

M. Coping:
1. Install wood nailers as shown on drawings.
2. Install metal cleats with appropriate fasteners spaced six (6) inches on center.
3. Install underlayment over the wood substrate. Lap ends minimum of six (6) inches and secure membrane in place. Seal laps with appropriate adhesive.
4. Install metal coping allowing 1/2 inch spaces between segments. Lock coping onto cleat and install appropriate fasteners through the interior fascia spaced 24 inches on center in enlarged holes.
5. Install cover plate centered over coping joint in continuous beads of specified Type B sealant, placed approximately one (1) inch from cover edges. Refer to SMACNA for alternate joints as required by length.
6. Install appropriate fastener through neoprene washer and cover plate between coping segments.
7. Accommodate building wall expansion joints by terminating coping joints and cleats either side of expansion joint. Do not run coping or cleats continuous across joints. Install coping cover plate to span across joint and lap coping on each side of joint a minimum of four (4) inches. Fasten cover plate on one (1) side of joint only. (Provide wall flashing membrane up and over parapet wall in accordance with manufacturer's detail.)

3.4 CLEANING AND PROTECTION

A. Remove flux and residual acid immediately by neutralizing with baking soda and washing with clean water. Leave work clean of stains.

B. Remove scraps and debris and leave work area clean.

C. Clean exposed metal surfaces, removing substances which might cause corrosion of metal or deterioration of finishes. Paint areas where finish is damaged on pre-finished metal by painting with a compatible paint in color to match undamaged finish.

D. Prime soldered area of phosphatized metal after cleaning to prevent rusting.

E. Paint metal flashings that have been soiled with bitumen with aluminized paint.

F. Clean other work damaged or soiled by Work of this Section.

G. Protect finished work from damage.

END OF SECTION 07 62 00

SECTION 07 72 00

ROOF ACCESSORIES

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Drawings and Conditions of Contract, including General and Supplementary Conditions and Division 1 Administration Sections, apply to this Division.

1.2 INSTALLATION RESPONSIBILITY

A. In addition to the items normally a part of this Section, coordinate the installation of roof accessory curbs and pipe flashings and equipment supports that may be specified elsewhere. Condition of the Contract and Division 01 applies to this section.

B. Coordinate the Work specified herein with the following Work:
   1. Roofing
   2. Roofing sheet metal
   3. Mechanical equipment
   4. Plumbing

1.3 REFERENCES

A. Federal Specifications (FS)
   1. TT-S-00227E

B. National Roofing Contractors Association (NRCA)

C. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA)
   1. Architectural Sheet Metal Manual

1.4 SUBMITTALS

A. Product Data: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, product variations, and accessories.

B. Shop Drawings: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

1.5 PRE-INSTALLATION CONFERENCE

A. Conduct Pre-Installation conference on site. Include Architect, Contractor, Sub-Contractor and manufacturer Representative.

1.6 WARRANTY

A. Warranty the Work specified herein for one (1) year against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials and workmanship.

B. Defects shall include, but not be limited to, the following:
   1. Noticeable deterioration of finish

2. Leakage of water into the building or within the construction.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Specifications are based on products of named manufacturers. Other manufacturers must have a minimum of five (5) years experience manufacturing products meeting or exceeding the specifications and comply with Division 1 requirements regarding substitutions to be considered.

2.2 PREFABRICATED ROOF CURBS

A. Frames:
   1. Material: ASTM A 653 G90 hot-dipped galvanized steel.
      a. Minimum 18 gauge, and as engineered by manufacturer.
      b. Minimum 18 gauge for curbs supporting HVAC units
      c. Minimum 20 gauge for expansion joint curbs.
   2. Corners: Mitered and welded (welds are micro sealed and prime painted after fabrication). Bolted connections not accepted.
   3. Base Plates: Integral to frame and welded.
   4. Internally reinforced with galvanized 1 inch by 1 inch by 12 gauge angles for curbs exceeding 3 foot length. Reinforce internal bulkhead at equipment curbs to support lateral loads.
   5. Wood Nailers: Factory installed, pressure treated. Size and width as suitable for support of items installed on curbs.

B. Insulation: Factory installed 1-1/2 inch thick three-pound density fiberglass insulation.

C. Curb Height: Minimum 8 inch above finished roof.
   1. Construct curbs to match roof slope with plumb and level top surface for mounting mechanical equipment.

D. Gasketing: 1/4 inch thick, one (1) inch wide at roof top units.
   1. Counterflashing: 24 gauge stainless steel

E. Counterflashing Cap: Stainless steel.

F. Cants:
   1. Non-canted curb style installs either under or on top of metal decks with insulation.
   2. Cants shall be provided under Section 07 52 19 - Roofing

G. All insulated roof curbs shall be structural and shall include calculations signed and sealed by a registered Structural Engineer. Refer to installation drawings for any additional structural requirements. If curbs do not span a minimum of two bar joists, only two angles will be required. Coordination mechanical equipment weight loading on the roof with Structural Engineer.

H. Approved Manufacturers:
   1. Custom Curb, Inc.
   2. Roof Products, Inc.

2.3 PIPE SUPPORTS (CANNOT BE CONTRACTOR BUILT SUPPORTS)

A. Gas Pipe Supports:

1. Provide strut and hanger type support with recycled plastics and carbon black for UV protection bases (10 inches x 16 inches x 3 inches; 6 lbs. each); Model Type PP-10 with strut & hanger for lines 2-1/2 inches and smaller, Model Type PS-1-2 with hanger for lines 3 inches and larger.
2. As manufactured by PHP Systems Design; Miro Industries Inc.; MAPA Products; Advanced Support Products or Architect approved equal.

B. Electrical Conduit / Condensate Lines:
1. Provide strut type support with recycled plastics and carbon black for UV protection bases (10 inches x 16 inches x 3 inches; 6 lbs. each), install with hold clips ordered as an accessory; Model Type PP-10 with strut. Model Type PS-1-2 with hanger for lines 3 inches and larger.
2. As manufactured by PHP Systems Design; Miro Industries Inc.; MAPA Products; Advanced Support Products or Architect approved equal.

C. Chill Water Lines:
1. Provide strut and hanger type support with recycled plastics and carbon black for UV protection bases (size as required); Model Type PS-1-2 and Model Type PSE-2-2 as required.
2. As manufactured by PHP Systems Design, Inc.; Miro Industries Inc.; MAPA Products; Advanced Support Products or Architect approved equal.

D. Installation:
1. Locate as indicated by Drawing at no greater than 8 feet-0 inches o.c.
2. Provide protective traffic pads below each support, tacked in place with approved mastic or adhesive.
3. Install hold down clips if indicated on the drawings or required.

2.4 ROOF TO ROOF EXPANSION JOINT

NOT USED

A. Stainless Steel expansion joint ~~wood curbs~~, as detailed on drawings and ~~outlined the~~ NRCA and SMACNA manual.

2.5 RETROFIT ROOF DRAINS

A. Retrofit Roof Drains: “Hercules RetroDrain” as manufactured by OMG, Inc. or Architect approved equal.
1. Size: To match existing roof drain sizes. [3 inches] [4 inches] [5 inches] [6 inches] [Indicated on the Drawings].
2. Compliance:
   a. ANSI / SPRI RD-1.
   b. ULC / ORD-C790.4.
3. Drain Body:
   a. Material: 1-piece, 11-gauge (0.125-inch) spun aluminum.
   b. Flange: 17-1/2-inch diameter.
4. Drain Stem Length: 12 inches
5. Flange Includes: Six 2-1/2-inch-long aluminum studs.
6. Sump Area: Depressed.

B. Strainer Dome:
1. Material: Cast aluminum.
2. Height: 7.25 inches.
3. Outside Base Diameter: 9.77 inches.

C. Clamping Ring:
   1. Material: Cast aluminum.
   2. Gravel Stop Height: 1.2 inches.
   3. Drainage Slots: 18 V-shaped.
   4. Bosses: 6, to accept studs on flange.

D. Backflow Seal:
   1. Compression Seal: Watertight, “U-Flow” mechanical seal.
   2. Material: Polyamide and EPDM rubber.
   3. Required for Activation: “U-Flow” screwdriver.

E. Hardware:
   1. Locknuts: 6, stainless steel, for studs.
   2. Screws: 3, stainless steel, to attach strainer to clamping ring.

F. Overflows:
   1. At overflow locations; provide overflow collar extension
   2. Constructed of spun aluminum

PART 3 EXECUTION

3.1 INSTALLATION

A. Install roof accessories in accordance with manufacturer's printed instructions and approved shop drawings. Installation of Portable Pipe Hangers shall not exceed six (6) feet on center.

B. Coordinate with roofing operation for watertight integrity.

C. Finished installation shall be water and air tight. Install sealant conforming to FS TT-S-00227E, Type II, Class A.

END OF SECTION 07 72 00

SECTION 07 92 00 – JOINT SEALANTS

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: Requirements including but not limited to:
   1. Control and expansion joints on exposed interior and exterior surfaces.
   2. Perimeter joints between wall surfaces and frames of interior and exterior doors and openings.
   3. Joints between plumbing fixtures and adjoining walls, floors, and counters.
   4. Joints indicated or as necessary.
   5. Accessories necessary for a complete installation.

1.3 RELATED SECTIONS

A. Section 03 30 00: Cast-In-Place Concrete

B. Section 05 50 00: Metal Fabrications.

C. Sections 08 Series: Doors.

D. Section 08 80 00: Glazing.

1.4 SUBMITTALS

A. Product Data: Technical data for each joint sealant product. Data to indicate elasticity and durability of each joint sealant product. Submit written certification from manufacturers of sealants attesting products are suitable for use indicated, verified through in house testing laboratory.
   1. Written certification from manufacturers of joint sealants attesting that products comply with specification requirements and suitable for use indicated verified through manufacturers testing laboratory within the past 36 months or since most recent reformulation, whichever is most recent.
      a. Complete instructions for handling, storage, mixing, priming, installation, curing and protection of each type of sealant.
      b. Manufacturer's letter, clearly indicating proposed lot numbers of each sealant supplied and expiration date sequence.
      c. Instructions for handling, storage, mixing, priming, installation, curing, and protection of each type of sealant.

   2. VOC Data: Submit manufacturer’s product data for sealants. Indicate VOC limits of the product. Submit MSDS highlighting VOC limits.
   3. Submit environmental data in accordance with Table 1 of ASTM E2129 for products provided under work of this Section.

B. Samples:
   1. Provide color samples from full manufacturer’s full range for each type of sealant specified for Architect’s review.

C. Certificates and Reports:
   1. Product Certificates: Manufacturer's product certificate for each kind of joint sealant and accessory.
   2. Sealant, Waterproofing, and Restoration Institute (SWRI) Validation Certificate: For each sealant specified to be validated by SWRI's Sealant Validation Program.
   3. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.
   4. Preconstruction Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
      a. Materials forming joint substrates and sealant backings have been tested for compatibility and adhesion with sealants.
      b. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

   5. Preconstruction Field Adhesion Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified.
   6. Field Adhesion Test Reports: For each sealant application tested.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Firm having minimum 5 years documented experience and specializes in the installation of sealants.
   1. Exposed sealant work (sealants used for air and weatherseals external at perimeter, metal panel to panel joints) shall be performed by a single (i.e. one) firm specializing in the installation of sealants who has successfully produced work comparable to project.
   2. Concealed sealant work (sealants which are internal to skylights, and providing an air seal) shall be the responsibility of the subcontractor providing erection of the respective system.

B. Source Limitations: Obtain each type of joint sealant from a single manufacturer.

C. Product Testing: Test joint sealants using a qualified testing agency.
   1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
   2. Test according to SWRI Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion in peel, and indentation hardness.

D. Environmental Requirements:
   1. Toxicity/IEQ: Comply with applicable regulations regarding toxic and hazardous materials.
      a. VOC Content of Interior Sealants: Sealants and sealant primers complying with limits for VOC content for SCAQMD when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
         1) Sealants: 250 g/L.
         2) Sealant Primers for Nonporous Substrates: 250 g/L.
         3) Sealant Primers for Porous Substrates: 775 g/L.

      b. Sealants containing aromatic solvents, fibrous talc, formaldehyde, halogenated solvents, mercury, lead, cadmium, chromium and their compounds, are not permitted.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials in compliance with manufacturer written instructions to prevent deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 degrees F (4.4 degrees C).
   2. When joint substrates are wet. Should joints or backing materials become wet, remove and replace backing material with new.

B. Joint Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

C. Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.8 WARRANTY

A. Installer's Warranty: Written warranty, signed by Installer agreeing to repair or replace elastomeric joint sealant work which has failed to provide a weathertight system within specified warranty period.
   1. Warranty Period: Five years from date of Substantial Completion.

B. Warranties: Written warranties (weatherseal and stain resistance), signed by sealant manufacturer agreeing to furnish joint sealants to repair or replace those that fail to provide airtight and watertight joints, or fail in adhesion, cohesion, abrasion resistance, stain resistance, weather resistance, durability, or appear to deteriorate in manner not specified in the manufacturer's data as an inherent quality of the material within specified warranty period.
   1. Warranty Period: 5 years from date of Substantial Completion.

C. Warranties specified exclude deterioration or failure of sealants from:
   1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
   2. Disintegration of joint substrates from natural causes exceeding design specifications.
   3. Mechanical damage caused by individuals, tools, or outside agents.
   4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Compatibility: Provide joint sealants, backings, and related materials compatible with one another and with joint substrates under conditions of service and application, as stated by sealant manufacturer’s published data, and as substantiated by the manufacturer for each application through testing.

B. Liquid Applied Sealants: Comply with ASTM C 920 and requirements indicated for each liquid applied sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

C. Stain Test Response Characteristics: For sealants in contact with porous substrates, provide nonstaining products that have undergone testing according to ASTM C 1248 and do not stain porous joint substrates.

D. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

E. Colors: For fully concealed joints, provide standard color of sealant that has the best overall performance characteristics for the application shown. For exposed joints, submit color samples to architect for approval, from manufacture's full line of standard colors.

F. Manufacturer's Representative: Use sealant produced by manufacturer who agrees to send a qualified technical representative to site upon request for the purpose of rendering advice concerning the recommended installation of manufacturer's materials.

G. Sealants: Self leveling compounds for horizontal joints in pavements and nonsag compounds elsewhere except as shown or specified.

H. Silicone Sealant: Comply with ASTM C920, Type M, Grade NS, Class 25; use NT, M, A and O.
   1. Use: Typical joints between masonry, metals, glass and plastics (Two part silicone sealants).
   2. Properties: Performance: Nonstain, nonbleed, nonstreaking to sealed and adjacent substrates. The minimum pli value after 7 day immersion shall not be less than 13 when tested in strict accordance with ASTM C794 Adhesion and Peel.
   3. Cure System and Oil Content: Neutral Cure System specifically manufactured with controlled oil content to eliminate oil migration into sealed substrates and residue rundown over and onto adjacent substrates.
   4. Product and Manufacturer: Dow Corning; 756 Silicone Building Sealant - HP with Additive.

I. Silicone Sealant: ASTM C 920, Type S, Grade NS, Class 50, for Use NT.
   1. Use: Typical joints between masonry, metals, glass and plastics (Single component sealants).
   2. Properties: Performance: Nonstain, nonbleed, nonstreaking to sealed and adjacent substrates.
   3. Cure System and Oil Content: Neutral Cure System specifically manufactured with controlled oil content to eliminate oil migration into sealed substrates and residue rundown over and onto adjacent substrates.
   4. Product and Manufacturer:
      a. BASF Building Systems; Omniseal 50.
      b. Dow Corning Corporation; 756 SMS, 791, 795, 995 as applicable.
      c. GE Advanced Materials, Silicones; SilGlaze II SCS2800, SilPruf NB SCS9000, SilPruf SCS2000, or UltraPruf II SCS2900 as applicable.
      d. Pecora Corporation, as applicable.
      e. Sika Corporation, Construction Products Division; SikaSil-C995.
      f. Tremco, as applicable.
      g. Comparable product.

J. Two Part Polyurethane Sealants: ASTM C920, Type M, Grade NS, Class 50; use NT, M, A and O.
   1. Use: Typical Wall and Floor Joints (Two Part Polyurethane Sealants).
   2. Properties: Performance: Nonstain, nonbleed, nonstreaking to sealed and adjacent substrates. The minimum pli value after 7 day immersion shall not be less than 13 when tested in strict accordance with ASTM C794 Adhesion in Peel.
   3. Products and Manufacturers: One of the following:
      a. BASF Construction Chemicals; NP 2.
      b. Pecora Corporation, as applicable.

c. Schnee-Morehead, Inc.; Permathane SM 7200.
d. Sika Corporation, Inc.; Sikaflex - 2c NS TG.
e. Tremco, as applicable.
f. Comparable product.

K. Mildew Resistant Silicone Sealant: ASTM C920, Type S, Grade NS, Class 25, Use NT, Substrate uses G, A, and O; and containing fungicide for mildew resistance; acid curing.
1. Use: One-part mildew-resistant silicone, formulated with fungicide for sealing interior joints of nonporous substrates around ceramic tile, plumbing fixtures, showers.
2. Products: Provide one of the following:
a. BASF Building Systems; Omniplus.
b. Dow Corning; 786 Mildew Resistant Silicone Sealant.
c. GE Silicones; Sanitary SCS 1700.
d. Pecora Corporation, as applicable.
e. Sika Corporation, Inc., as applicable.
f. Tremco, as applicable.
g. Comparable product.

L. Latex Sealant: Nonelastomeric, one part, nonsag, paintable latex sealant that is recommended for exposed applications on the interior. Complying with ASTM C 834, Type OP (opaque sealants):
1. Products: Subject to compliance with requirements, provide one of the following:
a. BASF; Sonolastic Sonolac.
b. Pecora Corporation; AC-20 + Silicone.
c. Sika Corporation, Inc., as applicable.
d. Tremco, as applicable.
e. Comparable product.

M. Acoustical Joint Sealant: Nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
1. Products: Subject to compliance with requirements, provide one of the following:
a. BASF, as applicable.
b. Pecora Corporation; AC-20 FTR or AIS-919.
c. Sika Corporation, Inc., as applicable.
d. Tremco, as applicable.
e. USG Corporation; SHEETROCK Acoustical Sealant.
f. Comparable product.

N. Sealant Backing: Provide sealant backings that are nonstaining; compatible with joint substrates, sealants, primers, and joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
1. Cylindrical Sealant Backings: Preformed, compressible, resilient, nonstaining, nonwaxing, nonextruding backings of flexible plastic foam complying with ASTM C 1330, and of type indicated below. Select shape and density of cylindrical sealant backings in consultation with the manufacturer for proper performance in specific condition of use in each case.
2. Type C: Closed cell polyethylene foam material with surface skin, nonabsorbent to liquid water and gas, nonoutgassing in unruptured state; one of the following:
a. BASF, as applicable.
b. HBR Closed Cell Backer Rod; Nomaco, Inc.
c. Pecora Corporation, as applicable.
d. Sonolastic Closed-Cell Backer-Rod; BASF Construction Chemicals.
e. Tremco, as applicable.
f. Comparable product.

O. Miscellaneous Materials:
1. Primer: Material recommended, as verified through compatibility and adhesion testing, by joint sealant manufacturer for the substrates indicated to be sealed.
2. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants with joint substrates.
3. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and which will not stain nor mar the finish of surface adjacent to joints to which it is applied.
4. Cork Joint Filler: Resilient and nonextruding, ASTM D1752, Type II.
5. Bond Breaker Tape: Polyethylene, TFE fluorocarbon, or plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self adhesive tape where applicable.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants for compliance with requirements for joint configuration, installation tolerances, and conditions affecting sealant performance. Proceed with installation after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with the recommendations of joint sealant manufacturer and requirements:
1. Remove foreign material from joint substrates interfering with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), existing joint sealants, oil, grease, water, surface dirt, and frost.
2. Clean concrete, masonry, unglazed surfaces of tile, and similar porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil free compressed air.
3. Remove laitance and form-release agents from concrete.
4. Clean metal, glass, porcelain enamel, glazed surfaces of tile, and other nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

B. Joint Priming (Elastomeric Sealants Only): Prime joint substrates where recommended in writing by joint sealant manufacturer, based on prior testing and experience. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION

A. Silicone Glazing Sealants: Refer to Section 08 80 00 Glazing.

B. Comply with joint sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

C. Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants applicable to materials, applications, and conditions indicated.

D. Sealant Backings: Install sealant backings to support sealants during application and at position necessary to produce cross sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
   1. Do not leave gaps between ends of sealant backings. Trim for tight fit around obstructions or elements penetrating the joint.
   2. Do not stretch, twist, puncture, or tear sealant backings.
   3. Remove absorbent sealant backings that become wet before sealant application and replace with dry sealant backings.
   4. Install bond breaker tape behind sealants where backings are not used between sealants and back of joints.

E. Weeps and Vents: Install weeps and vents into joints at the same time sealants are being installed. Locate weeps and vents spaced recommended by sealant manufacturer and the window and curtain wall fabricator and erector. Do not install weeps and vents at outside building corners. Do not install vents at horizontal joints immediately below shelf angles, sills, and through wall flashings.

F. Sealants: Install sealants by proven techniques resulting in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at same time sealant backings are installed.
   1. Apply sealants in depth in accordance with manufacturer's recommendations and recommended general proportions and limitations.
   2. Apply elastomeric sealants, in joints not subject to traffic or abrasion, to a depth equal to 50% of the joint width, but not less than 1/4 inch (6 mm) and not more than 1/2 inch (13 mm).
   3. Apply nonelastomeric sealants to a depth approximately equal to the joint width.

G. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants to form smooth, uniform, beads to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces. Tool exposed surfaces of sealants to the profile shown, or if none is shown, tool slightly concave.
   1. Use masking tape to protect adjacent surfaces of recessed tooled joints.
   2. Provide a slight wash on horizontal joints where horizontal and vertical surfaces meet.
   3. Against rough surfaces or in joints of uneven widths avoid the appearance of excess sealant or compound by locating the compound or sealant well back into joint wherever possible.

H. Installation of Preformed Silicone Sealant System:
   1. Apply masking tape to each side of joint, outside of area to be covered by sealant system.
   2. Apply silicone sealant to each side of joint to produce a bead of size complying with preformed silicone sealant system manufacturer's written instructions and covering a bonding area of not less than 3/8 inch (10 mm). Hold edge of sealant bead 1/4 inch (6 mm) inside masking tape.
   3. Within 10 minutes of sealant application, press silicone extrusion into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact between sealant and both extrusion and substrate.

4. Complete installation of sealant system in horizontal joints before installing in vertical joints. Lap vertical joints over horizontal joints. At ends of joints, cut silicone extrusion with a razor knife.

I. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping. Do not pull or stretch material. Produce seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures, apply heat to sealant in compliance with sealant manufacturer's written instructions.

J. Acoustical Sealant Installation: At sound rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer written recommendations.

3.4 FIELD QUALITY CONTROL

A. Field Adhesion Testing: Field test exterior wall joint sealant adhesion to joint substrates:
1. Extent of Testing: Test completed and cured sealant joints:
   a. Perform 10 tests for the first 1000 feet (300 m) of joint length for each kind of sealant and joint substrate.
   b. Perform 1 test for each 1000 feet (300 m) of joint length thereafter or 1 test per each floor per elevation.

2. Test Method: Test joint sealants according to Method A, Field Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
3. Inspect tested joints and report on the following:
   a. Whether sealants filled joint cavities and are free of voids.
   b. Whether sealant dimensions and configurations comply with specified requirements.
   c. Whether sealants in joints connected to pulled out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer field adhesion hand pull test criteria.

4. Record test results in a field adhesion test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure original sealant surfaces are clean and new sealant contacts original sealant.

B. Evaluation of Field Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 SITE ENVIRONMENTAL PROCEDURES

A. Indoor Air Quality: Provide temporary ventilation during work. Coordinate interior application of sealants with interior finishes schedule.

3.6 CLEANING AND PROTECTION

A. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

B. Protect joint sealants during and after curing from contact with contaminating substances and from damage so sealants are without deterioration or damage at time of Substantial Completion. If, despite protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from the original work.

END OF SECTION 07 92 00

SECTION 08 11 13 HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Provide items shown on the Drawings and specified, including, but not limited to the following:
   1. Standard and fire rated steel doors.
   2. Steel frames for doors, sidelites, transoms, and windows.
   3. Louvers and vision lites in steel doors, if shown or required.
   4. Sound rated steel doors.
   5. Thermally rated steel doors.

B. Related Sections:
   1. Section 05 40 00: Cold-Formed Metal Framing.
   2. Section 07 92 00: Joint Sealants.
   3. Section 08 80 00: Glazing.
   4. Section 09 21 16: Gypsum Board Assemblies.
   5. Section 09 24 00: Cement Plastering.
   6. Section 09 90 00: Painting and Coating.

C. Reference Standards:
   1. ASTM International (ASTM):
      a. A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
      b. A924 Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
      c. A1008 Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
      d. A1011 Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
      e. C1363 Standard Test Method for the Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
      f. E283 Standard Test Method for Determining the rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
      g. E413 Standard Classification for Rating Sound Insulation.
   2. Hollow Metal Manufacturers Association (HMMA):
      a. HMMA 802 Manufacturing of Hollow Metal Doors and Frames.
      b. HMMA 810 Hollow Metal Doors.
      c. HMMA 830 Hardware Preparation and Locations for Hollow Metal Doors and Frames.
      d. HMMA 840 Installation and Storage of Hollow Metal Doors and Frames.
      e. HMMA 850 Fire Rated Hollow Metal Doors & Frames.
      f. HMMA 890 Technical Summary of Hollow Metal by HMMA.
   3. National Fire Protection Association (NFPA):
      a. 80 Fire Doors and Fire Windows.
      b. 252 Fire Tests of Door Assemblies.

4. Steel Door Institute – Current Standards: Technical Data Series.
5. Underwriters Laboratories Inc. (UL):
   a. Building Materials Directory.
   b. Listing and Labeling.
   c. 10B and 10C Fire Tests of Door Assemblies.
   d. 1784 Air Leakage Tests of Door Assemblies.
6. Intertek Testing, Services (Warnock Hersey, Inc. (WHI): Listing and Labeling.

1.3 SUBMITTALS

A. Product Data:
   1. Manufacturer's standard details and catalog data demonstrating compliance with specifications and referenced standards.
   2. Manufacturer's installation instructions.

B. Shop Drawings:
   1. Indicate complete schedule in detail for each steel door and frame using the same reference number for details and openings as those on the contract Drawings. If any door is not by the steel door manufacturer, only the door opening number should be shown along with the type of door (wood, plastic laminate faced, etc.):
      a. Show details of construction, installation, connections, anchors, hardware reinforcement, hardware preparation, louvers, and floor and threshold clearances.

C. Samples are required from non-Steel Door Institute members:
   1. 12-inch by 12-inch sample of a fire-rated and non-rated door, cut from corner of door, showing door construction.
   2. 12-inch by 12-inch sample of each type of door louver specified or required, showing louver construction.
   3. Six-inch (6”) long sample of a fire-rated, non-rated frame, and each type of glass stop specified or required, showing corner and construction.

D. Certificates: Manufacturer’s certification that oversized openings are in compliance with specifications.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: If other than a manufacturer listed under Paragraph 2.1 is proposed for use on the Project, it shall be a company specializing in the manufacturer of steel doors and frames of the type specified for this Project with a minimum of five (5) years’ experience.

B. All steel doors and frames shall be by a single manufacturer, shop drawings to be submitted with manufacturer’s insignia, which is being supplied.

C. Furnish steel doors and frames to meet current ANSI/Steel Door Standards.

D. ANSI A250.13 Testing and Rating of Sever Windstorm Resistant Components for Swing Door Assemblies.

E. ASTM E330, Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.

F. Comply with ASTM E283 Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

G. Regulatory Requirements:
   1. Fire-Rated Assemblies:
      a. Fire-rated door, panel, frame, and fire window construction shall conform to NFPA 252, or UL 10B, as applicable, and acceptable to the code of authorities having jurisdiction.
      b. Fire-rated door construction:
         1) Notwithstanding any other requirements of this Section, provide gauge of metal, method of construction, hardware preparation, reinforcement, and placement, glass opening size, and other specifics required to obtain the specified or required label. The label shall contain the fire resistance rating (20-minute, 45-minute, 1-hour, 1-1/2-hour, 3-hour, etc.) and the designation (A, B, C, D, or E); doors with B Label shall be 1-1/2 hour.
         2) Fire-rated doors used in a stairway enclosure, shall be so constructed so that the maximum transmitted temperature shall not exceed 450 degrees F above ambient temperature at the end of 30 minutes of the Standard Fire Exposure Test and shall be so noted on the label.
      c. Fire-rated openings:
         1) Conform to NFPA 80 for fire-rated class shown or required by code of authorities having juris

NOT USED

            a) Units shall be ide plies whose fire resistance characteristics have been determined in accordance with requirements specified above, and shall be labeled and listed by UL, WHI, or other inspection and testing agency acceptable to the code of authorities having jurisdiction.
            b) Fire-rated steel doors, panels, frames, and fire windows shall bear permanent labels attesting to fire resistance. At stairway enclosures, provide units listed for 450 degree F maximum temperature rise rating for 30 minutes of exposure.
            c) Oversized openings shall be constructed in accordance with all applicable requirements for labeled door construction.
            d) Fire rated door assemblies with gaps in excess of 1/8 inch between door and frame will not comply with NFPA 80.
            e) Locate label on hinge side of doors and frames so that when door is closed, label is not visible.
            f) Caution shall be taken to ensure that labels are not removed, damaged, or painted over.
            g) Glass panes shall not exceed sizes allowed whether indicated or not on the Drawings.

H. Wind Loads: Provide hollow metal and door hardware assemblies approved by DSA, including anchorage, capable of withstanding wind load design pressures that are calculated for this Project by a registered Architect or Engineer and is part of the construction documents per CBC.

I. Hurricane-Resistance Test Performance:
   1. Provide hollow metal and door hardware approved assemblies that pass large missile-impact tests, as required by authorities having jurisdiction:
      a. Impact resistance: Hollow metal with approved door hardware assemblies must satisfy Division of the State Architect and CBC for protection from windborne debris. The assemblies must have passed the large missile impact test, which equates to Missile Level D specified in ASTM E1996. The assemblies may be installed at any height on the structure as long as the design pressure rating for the assemblies is not exceeded. These assemblies will and do not need to be protected with an impact protective system when installed in areas where windborne debris protection is required.

J. Accessibility Requirements:
1. Comply with applicable requirements:
a. Americans with Disability Act of 1990, as amended: 2010 ADA Standards.
b. CBC 2022 California Building Code. CCR Title 24, Part 2, as adopted and amended by DSA.

1.5 WARRANTY

A. Warrant the work specified herein for one (1) year against becoming unserviceable or causing an objectionable appearance resulting from either defective or non-conforming materials and workmanship.

B. Defects shall include, but not be limited to:
1. Use of incorrect materials in opening.
2. Incorrect labeled components installed within opening.
3. Noisy, rough, or difficult operation.
4. Failure to meet specified quality assurance requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in accordance with manufacturer’s instructions, and as follows:
1. In manufacturer's original, clearly labeled, undamaged containers or wrappers.
2. Containers or wrappers shall list the name of the manufacturer and product.

B. Deliver materials to allow for minimum storage time at the Project site. Coordinate delivery with the scheduled time of installation.

C. Protect products from moisture, construction traffic, and damage:
1. Store under cover in a clean, dry place, protected from weather and abuse.
2. Store in a manner that will prevent rust or damage.
3. Store doors in a vertical position, spaced with blocking to permit air circulation.
4. Do not use non-vented plastic or canvas shelters.
5. Should containers or wrappers become wet, remove immediately.

PART 2 PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Manufacturers listed below whose products meet or exceed the specifications are approved for use on the Project. Other manufacturers must comply with Manufacturer Qualifications, must manufacture equivalent products to those specified, and comply with requirements of Section 01 26 00: Contract Modification Procedures regarding substitutions to be considered:
1. CECO Door Products, Brentwood, TN; (615) 661-5030.
2. Curries Company, Mason City, IA; (515) 423-1334.
3. Pioneer Industries, Inc., Kewanee, IL; (309) 856-6000.
4. Republic Builders Products Company, McKenzie, TN; (800) 733-3667.
5. Steelcraft Mfg. Co., Cincinnati, OH; (513) 745-6400.
6. Approved equal.

2.2 MATERIALS, GENERAL

A. Steel requirements, all frames to be manufactured of commercial quality, stretcher leveled flatness, cold rolled steel per ASTM A1008 general requirements. Internal reinforcing may be manufactured of hot rolled pickled and oiled steel per ASTM A1011. Exterior frames and

interior frames where shown on Drawings or required in damp, moist, humid, and wet areas, i.e., toilets, locker rooms, showers, etc., to be manufactured of commercial quality, stretcher leveled flatness, cold rolled steel and galvannealed to A-60 minimum coating weight standard per ASTM A653 and A924, with coating weight of not less than 0.60 ounce per square foot (0.30 ounce per square foot per side).

2.3 FRAME FABRICATION

A. Minimum Gauges:
   1. Interior openings:
      a. Less than four feet (4') width: 16 gauge.
      b. Four feet (4') in width and greater: 14 gauge.
   2. Exterior openings: 14 gauge

B. Design and Construction:
   1. Frames shall be custom made, welded units with integral trim of sizes and shapes shown on approved shop drawings. Hinge jambs that butt adjacent 90-degree walls shall have at least four-inch (4") wide frame face to assure the door trim will not strike the wall prior to the door opening at least 90 degrees. Frame profile shall match wall thickness where practical, i.e., 4-3/4-inch at four-inch (4") CMU, 6-3/4-inch at six-inch (6") CMU, and 8-3/4-inch at eight-inch (8") CMU. At masonry wall openings, fabricate frames to suite masonry opening with two-inch (2") head member.
   2. Frames shall be strong and rigid, neat in appearance, square, true, and free of defects, warp, and buckle. Molded members shall be clean cut, straight, and of uniform profile throughout their length.
   3. Jamb depths, trim, profile, and backbends shall be as shown on approved shop drawings.
   4. Corner joints, including face and inside corners, shall have contact edges closed tight, with trim faces mitered and continuously welded, and stops butted. The use of gussets shall not be permitted. Face of frame shall be ground smooth. Knockdown (KD) frames are not permitted.
   5. Minimum depth of stops shall be 5/8 inch, except at fire windows where minimum depth of stops shall be 3/4 inch.
   6. Frames for multiple openings shall have mullion and rail members that are closed tubular shapes having no visible seams or joints. Joints between faces of abutting members shall be securely welded and finished smooth. Mullions shall be key locked removable type. Keys shall be master keyed to Owner's Best system.
   7. High frequency hinge reinforcement: Provide high frequency hinge reinforcements at door openings 48-inch and wider with mortise/butt type hinges only at top hinge location to deter against hinge reinforcement sag.
   8. Continuous hinge reinforcement: Provide welded continuous 12-gage strap for continuous hinges specified in hardware sets in Division 08 Openings.
   9. Provide countersunk flat or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops; provide security head screws at exterior locations.
   10. Provide A60 galvannealed coating at frames in restrooms and locker rooms with showers/Jacuzzi, clean areas such as kitchen rooms.
   11. Electrical knock out boxes:
      a. Factory weld 18-gage electrical knock out boxes to frame for electrical hardware preps; included but not limited to electric thru wire hinges, electrical raceways, door position switches, electric strikes, jamb mount card readers, and magnetic licks as noted in door hardware sets in Division 08 Openings:
         1) Electrical knock out boxes are required at door position switches, electric strikes, card readers, and middle hinge locations.
         2) Provide electrical knock out boxes with 3/4-inch knockouts.
         3) Conduit to be coordinated and installed in field from middle hinge box and

strike box to door position box.
4) Electrical knock out boxes to comply with NFPA requirements and fit electrical door hardware as specified in hardware sets in Division 08 Openings.
5) Electrical knock out boxes for continuous hinges should be located in the center of the vertical dimension on the hinge jamb.
6) Provide field installed conduit per Division 28: Electronic Safety & Security Section for standardized plug connectors to accommodate up to twelve (12) wires as required for electrified door hardware specified in hardware sets in Division 08 Openings. Provide sufficient number of concealed wires to accommodate electric function of specified hardware. Wire nut connections are not acceptable.

12. Hardware reinforcements:
    a. Frames shall be mortised, reinforced, drilled, and tapped at factory for fully template mortised hardware in accordance with approved hardware schedule and templates provided by Section 08 71 00: Door Hardware. Where surface-mounted hardware is to be applied, frames shall have reinforcing plates only.
    b. Minimum thickness of hardware reinforcing plates shall be as follows:
        1) Hinge and pivot reinforcements (1-1/4-inch x 10-inch minimum size): Seven (7) gauge.
        2) Strike reinforcements: 12-gauge stiffeners.
        3) Flush bolt reinforcements: 12-gauge.
        4) Closer reinforcements: 12-gauge.
        5) Reinforcements for surface-mounted hardware, hold-open arms, and surface panic devices: 12-gauge.
13. Floor anchors: Minimum 14-gauge, securely welded inside each jamb, with holes for floor anchorage.
14. Jamb anchors:
    a. Frames for installation in masonry walls shall be provided with adjustable jamb anchors of the T-strap type. Anchors shall be not less than 16-gauge steel. The number of anchors provided at each jamb shall be as follows:
        1) Frames up to seven-feet-six-inches (7’-6”) in height: Three (3) anchors.
        2) Frames seven-feet-six-inches (7’-6”) to eight feet (8’) in height: Four (4) anchors.
        3) Frames over eight feet (8’) in height: One (1) anchor for each two feet (2’) or fraction thereof in height.
    b. Frames for installation in wood or metal stud partitions shall be provided with steel anchors of suitable approved design, not less than 16-gauge thickness, securely welded inside each jamb as follows:
        1) Frames up to seven feet six inches (7’-6”) in height: Four (4) anchors.
        2) Frames seven feet six inches (7’-6”) to eight feet (8’) in height: Five (5) anchors.
        3) Frames over eight feet (8’) in height: Four (4) anchors plus one (1) additional for each two feet (2’) or fraction thereof over eight feet (8’).
    c. Frames to be anchored to previously placed concrete, masonry, or structural steel shall be provided with anchors of suitable design as shown on approved shop drawings.
15. Dust cover boxes: Shall be of not less than 26-gauge steel and shall be provided at all mortised hardware items. Eight-inch (8”) CMU walls with face brick shall have dual offset jamb anchors.
16. Steel spreader: Shall be provided on all frames, temporarily attached to bottoms of both jambs for bracing during shipping and handling.
17. Loose glazing stops: Shall be of cold rolled steel, not less than 20 gauge, butted at corner joints and secured to the frame with countersunk cadmium or zinc-plated screws. Loose stops at exterior frames shall be placed on the interior side of the frames.

18. At sound rated door openings and at masonry openings, coat inside of frame profile with corrosion resistant coating to minimum thickness of 1/16 inch.

C. Frame Color: Field painted under Section 09 90 00: Painting and Coating to match face of door.

2.4 DOOR FABRICATION

A. Minimum Gauges:
1. Interior doors: 0.047 inch or 18 gauge (16 gauge for high frequency doors).
3. Exterior doors: 0.059 inch or 16 gauge (14 gauge for windstorm rated doors).

B. Design and Construction:
1. Types: Doors shall be custom fabricated, of types and sizes shown on approved shop drawings, and shall be seamless face construction with no visible seams or joints on vertical edges with fully welded seams free from blemishes and defects. Thickness shall be 1-3/4 inch, unless specifically noted or shown otherwise.
4. Exterior doors: Provide doors with 22-gage steel z-channels placed at six inches (6”) apart with foamed in place polyurethane core, with a thermal insulation calculated R factor of 11.01 per ASTM C518 Standards.
5. Fabrication:
   a. Doors shall be strong, rigid, and neat in appearance, free from warpage and buckle.
   b. Corner bends shall be true and straight and of minimum radius for gage of metal used.
   c. Provide stiffeners with polystyrene core spaced maximum six inches (6”) on center and extending full height of door.
   d. Fill interior with noncombustible fiberglass insulation. Use mineral board filler as required for labeled doors.
   e. Faces shall be joined at vertical edges of door by a continuous weld extending full height of door. Welds shall be ground, filled, and dressed smooth to provide a smooth flush surface.
   f. Top and bottom edges of doors shall be closed with a continuous recessed steel channel not less than 16 gauge, extending full width of door and spot weld to both faces. Exterior doors shall have an additional flush closing channel at top and bottom edges. Openings shall be provided in the bottom closure channel at top and bottom edges. Openings shall be provided in the bottom closure of exterior doors to permit the escape of entrapped moisture.
   g. Continuous hinge reinforcement: Provide welded continuous 12-gage strap for continuous hinges specified in hardware sets in Division 08: Openings.
   h. Electrical raceways: Provide raceways for standardized plug connectors to accommodate up to 12 wires as required for electrified door hardware specified in hardware sets in Division 08: Openings. Provide sufficient number of concealed wires to accommodate electric function of specified hardware. Wire nut connections are not acceptable.
   i. Doors in wet or humid areas shall have a top cap and solid foam interior core to prevent internal moisture accumulation and galvannealed.
   j. Edge profile shall be provided on both vertical edges of door as follows:
      1) Single-acting swing doors: Beveled 1/8 inch in two inches (2”).
   k. Hardware reinforcements:
      1) Doors shall be mortised, reinforced, drilled, and tapped at factory for fully template hardware, in accordance with the approved hardware schedule and templates provided by Section 08 71 00: Door Hardware. Where surface-mounted hardware is to be applied, doors shall have reinforcing plates only.
      2) Minimum gauges for hardware reinforcing plates shall be as follows:
         a) Hinge and pivot reinforcements: Seven (7) gauge.

b) Reinforcements for lock face, flush bolts, concealed holders, concealed or surface-mounted closers: 12 gauge.

6. Glass moldings and stops: Loose stops shall be not less than 20-gauge steel, with butt corner joints, secured to frame opening by countersunk screws. Snap-on attachments will not be acceptable.
7. Louvers: Shall be inverted "V" blade, sight-proof type, unless noted otherwise.
8. Edge clearances:
   a. Between door and frame at head and jambs: 1/8 inch.
   b. At doorsills with no threshold: 5/8-inch to 3/4-inch above finished floor.
   c. At doorsills with threshold: As required to suit threshold.
   d. Between meeting edges of double doors: 1/8 inch.

C. Finish:
1. Shop paint steel (whether galvanized or ungalvanized) stops and accessories as follows:
   a. Clean surfaces free of mill scale, rust, oil, grease, dirt, and other foreign matter.
   b. Chemically treat surfaces and apply one (1) coat of an approved baked-on rust-inhibitive primer paint to provide a minimum 0.5 mil dry film thickness.
2. Field painted under Section 09 90 00: Painting and Coating.

D. Sound Rated Door: STC of 32, measured in accordance with ASTM E413.

E. Thermal Insulated Door: Total insulation R-Value of 44 measured in accordance with ASTM C1363, unless otherwise noted on Drawings.

2.5 LABELED DOORS AND FRAMES

A. Labeled doors and frames shall be provided for openings requiring fire protection ratings as scheduled and to comply with NFPA 80. Such doors and frames shall be constructed as tested and approved by UL, WHI, or other nationally recognized testing agency having a factory inspection service and approved by code authorities having jurisdiction and shall bear the appropriate permanent label.

B. If any door or frame scheduled to be fire-rated cannot qualify for appropriate labeling because of its size, design, hardware, or other reason, the Architect shall be so advised before fabrication work on that item is started. Indicate and highlight on shop drawing.

PART 3 EXECUTION

3.1 COORDINATION

A. Coordinate the work of this Section.

B. Coordinate hardware installation with opening construction. Finish hardware is specified in Section 08 71 00: Door Hardware.

C. Coordinate doors, frames, and windows with glazing specified in Section 08 80 00: Glazing.

D. Coordinate doors and frames with painting specified in Section 09 90 00: Painting and Coating.

3.2 INSTALLATION

A. Separate dissimilar metals. Protect against galvanic action.

B. Frames:
   1. Anchorage and connections: Secure to adjacent construction. Where practical, interior door frames shall be flush with the pull side wall to minimize or eliminate the reveal and allow full 180-degree door swing.
   2. Install frames in accordance with manufacturer's instructions and install labeled frames in accordance with NFPA 80.
   3. Frame spreader bars: Leave intact until frames are set perfectly square and plumb and anchors are securely attached.
   4. Remove hardware, with the exception of prime-coated items, tag box, and reinstall after finish paint work is completed. Do not remove or paint over labels on labeled frames.

C. Doors:
   1. Install hardware in accordance with hardware manufacturer's templates and instructions.
   2. Install doors in accordance with manufacturer's instructions and install labeled doors in accordance with NFPA 80.
   3. Adjust operable parts for correct function.
   4. Remove hardware, with the exception of prime-coated items, tag, box, and reinstall after finish paint Work is completed. Do not remove or paint over labels on labeled doors.

3.3 ADJUST AND CLEAN

A. Adjust doors for proper operation, free from binding or other defects.

B. Clean and restore soiled surfaces.

C. Remove scraps and debris, and leave site in clean condition.

END OF SECTION 08 11 13

SECTION 08 14 16 FLUSH WOOD DOORS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements including but not limited to:
   1. WI Certified, fire-rated and non-rated, flush panel wood doors.
   2. Solid core doors with MDF and plastic laminate faces.
   3. Integration of a security system.
   4. Factory fitting flush wood doors to frames and factory machining for hardware.
   5. Accessories necessary for a complete installation.

B. Related Sections:
   1. Section 05 50 00: Metal Fabrications.
   2. Section 07 92 00: Joint Sealants.
   3. Section 08 11 13: Hollow Metal Doors and Frames.
   4. Section 08 80 00: Glazing.
   5. Section 09 21 16: Gypsum Board Assemblies.
   6. Section 09 24 00: Cement Plastering.

1.3 SUBMITTALS

A. Product Data:
   1. Technical data for each type of door indicated:
      a. Include details of core and edge construction, louvers, and trim for openings.
      b. Include factory finishing specifications.
      c. Include laboratory test report results of hinge loading, cycle/slam, stile edge screw withdrawals, and stile edge split resistance for fire rated doors.

B. Shop Drawings:
   1. Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:
      a. Dimensions and locations of blocking.
      b. Dimensions and locations of mortises and holes for hardware.
      c. Dimensions and locations of cutouts.
      d. Undercuts.
      e. Requirements for veneer matching.
      f. Doors to be factory finished and finish requirements.
      g. Fire-protection ratings for fire rated doors.

C. Certificate of Compliance for Fire Rated Doors: Provide copies of Certificate of Compliance for fire rated door assemblies and smoke and draft control door assemblies.

D. Certificate of Compliance regarding WI construction grade.

E. Certificate of Compliance regarding WI installation requirements.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Fire rated wood doors - NFPA 80 listed and labeled by UL for fire protection ratings indicated, based on testing at positive pressure according to UL 10C:
      a. Oversize fire rated door assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for siz
      b. Temperature rise limit: A
   2. Smoke and draft control door assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.
   3. Accessibility requirements - comply with applicable requirements:
      a. Americans with Disabilities Act of 1990, as amended:
         1) ADA Title II Regulations & the 2016 ADA Standards for Accessible Design.
      b. CBC 2022 California Building Code (CCR Title 24, Part 2, as adopted and amended by DSA:
         2) CBC Chapter 11B, Access to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing.
   4. Quality standard: In addition to requirements specified, comply with Woodwork Institute WI Manual of Millwork
   5. Maintain at least one copy of WI Manual for reference at jobsite throughout installation period.

NOT USED

B. Source Limitations: Obtain flush wood doors through one (1) source from a single manufacturer.

C. Pre-Installation Conference: Conduct conference at site.

1.5 WARRANTY

A. Warranty:
   1. Written warranty signed by manufacturer, installer, and Contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship. A representative of the door manufacturer shall inspect the installed doors and shall note on the warranty that no provisions of the warranty have been nullified in the manufacture and/or installation:
      a. Failures include, but are not limited to, the following:
         1) Warping (bow, cup, or twist) more than 1/4-inch (6.4 mm) in a 42-inch by 84-inch (1,067 mm by 2,134 mm) section.
         2) Telegraphing of core construction in face veneers exceeding 0.01-inch in a three-inch (0.25 mm in a 76.2 mm) span.
      b. Warranty include installation and finishing that may be required due to repair or replacement of defective doors.
      c. Warranty period for solid core exterior doors: Five (5) years from date of Substantial Completion.
      d. Warranty period for solid core interior doors: Life of installation.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect wood doors during transit, storage, and handling to prevent damage, soiling, and deterioration. Store wood doors on a flat level surface in a dry, well ventilated, place. Keep wood doors a minimum of 3-1/2 inches (85 mm) off floor surface and protected by a protective covering under the bottom door and over the top door. Covering should protect wood doors from dirt, water, and abuse but allow for air circulation under and around the

stack. Do not store wood doors in direct sunlight. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in heavy duty cardboard cartons prior to shipment from factory. Mark each door on top and bottom rail with opening number used on shop drawings using temporary, removable, or concealed markings.

C. Handle wood doors with clean gloves. Lift and carry wood doors when moving them around the site; do not drag wood doors across one another.

PART 2 PRODUCTS

2.1 MATERIALS

A. Manufacturers are subject to compliance with requirements; provide flush wood door products by one of the following:
1. Haley Brothers, Inc.
2. Oshkosh Door Company.
3. Oregon Door.
4. Weyerhaeuser.
5. Approved equal.

B. Manufacturers are subject to compliance with requirements; provide high pressure laminate products by one of the following:
1. Formica Corp.
2. Panolam Surface Systems.
3. Wilsonart LLC.
4. Approved equal.

C. Fire Rated Wood Doors - Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C:
1. Cores: Provide core specified or mineral core as necessary to provide fire protection rating indicated.
2. Edge construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
3. Pairs: Provide fire retardant stiles listed and labeled for applications indicated without formed steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
4. Pairs:
    a. Provide formed steel edges and astragals with intumescent seals:
        1) Finish steel edges and astragals with baked enamel same color as doors.
        2) Finish steel edges and astragals to match door hardware (locksets or exit devices).

D. Smoke and Draft Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.

E. Particleboard Core Doors:
1. Blocking:
    a. Provide wood blocking in particleboard core doors as necessary to eliminate through-bolting hardware:
        1) Five-inch (125 mm) top rail blocking in all doors, whether or not closers are scheduled.
        2) Five-inch (125 mm) bottom rail blocking, in exterior doors and doors

indicated to have protection plates.
3) Five-inch (125 mm) midrail blocking, in doors indicated to have exit devices.
4) 4-1/2-inch by ten-inch (114 mm by 250 mm) lock blocks, in doors indicated with lock and latch sets.

2. Provide doors with glued wood stave or structural composite lumber cores instead of particleboard cores for doors indicated to receive exit devices.

F. Fire Rated Wood Doors with Plastic Laminate Face - Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C:

1. Core: Noncombustible mineral product complying with requirements and testing and inspecting agency for fire protection rating indicated.
2. Blocking:
   a. Provide composite blocking with improved screw-holding capability approved for use in doors of fire protection ratings indicated as follows:
      1) Five-inch (125 mm) top rail blocking in all doors, whether or not closers are scheduled.
      2) Five-inch (125 mm) bottom rail blocking, in doors indicated to have protection plates.
      3) Five-inch (125 mm) midrail blocking, in doors indicated to have exit devices.
      4) 4-1/2 inch by 10 inch (114 mm by 250 mm) lock blocks, in doors indicated with lock and latch se NOT USED
3. Edge Construction:
   a. Provide fire rated door edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges:
      1) At hinge stiles, provide laminated edge construction with improved screw holding capability and split resistance:
         a) Screw holding capability: 550 lbf (2440 N) per WDMA T.M.-10.
      2) Pairs:
         a) Provide fire retardant stiles listed and labeled for applications indicated without formed steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges. Where required, provide formed steel edges and astragals with intumescent seals. Finish steel edges and astragals with baked enamel.
4. Smoke and draft control door assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.

2.2 PLASTIC-LAMINATE-FACED DOORS

A. Particleboard Core Doors with Plastic Laminate Face:

1. Grade and construction: WI custom grade, PC-5; 1-3/4 inch unless otherwise indicated.
2. Core - ANSI A208.1, particleboard or MDF, made with binder containing no urea formaldehyde resin: Provide doors with glued block or structural composite lumber cores instead of particleboard cores at locations where exit devices are indicated.
3. Blocking:
   a. Provide wood blocking in particleboard core doors necessary to eliminate through bolting hardware:
      1) Five-inch (125 mm) top rail blocking. in all doors, whether or not closers are scheduled.
      2) Five-inch (125 mm) bottom rail blocking in doors indicated to have protection plates.
      3) Five-inch (125 mm) midrail blocking, in doors indicated to have exit devices.
      4) 4-1/2-inch by ten-inch (114 mm by 250 mm) lock blocks, in doors indicated with lock and latch sets.

4. Exposed vertical and horizontal edges - impact resistant polymer edging, applied after faces:
   a. Polymer edging color: Match face color.
5. Construction: Five (5) plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before faces and crossbands are applied. Faces are bonded to core using a hot press**.**
6. Crossbanding: Minimum 1/16-inch thick, low density hardwood, composite, or high density hardboard.
7. Face: 3-ply AWI PC-HPDL-3 High Pressure Decorative Laminate (HPDL).

2.3 PAINTED DOORS (OPAQUE FINISH)

A. Particleboard Core Doors with Painted Finish:
   1. Grade and construction: AWI custom grade, PC-5; 1-3/4 inch unless otherwise indicated.
   2. Core - ANSI A208.1, particleboard or MDF, made with binder containing no urea formaldehyde resin: Provide doors with glued block or structural composite lumber cores instead of particleboard cores at locations where exit devices are indicated.
   3. Blocking:
      a. Provide wood blocking in particleboard core doors necessary to eliminate through bolting hardware:
         1) Five-inch (125 mm) top rail blocking in all doors, whether or not closers are scheduled.
         2) Five-inch (125 mm) bottom rail blocking in doors indicated to have protection plates.
         3) Five-inch (125 mm) midrail blocking, in doors indicated to have exit devices.
         4) 4-1/2-inch by ten-inch (114 mm by 250 mm) lock blocks, in doors indicated with lock and latch sets.
   4. Exposed vertical and horizontal edges:
      a. Seal all exposed edges with primer and provide opaque finish.
      b. Color: Match face color and finish unless noted otherwise.
      c. Labels: Mask labels prior to field painting where doors are not delivered with factory finish.
   5. Construction: Five (5) plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before faces and crossbands are applied. Faces are bonded to core using a hot press.
   6. Crossbanding: Minimum 1/16-inch thick, low density hardwood, composite, or high density hardboard.
   7. Face: Paint grade medium density overlay (MDO).

2.4 LIGHT FRAMES AND LOUVERS

A. Metal Frames for Light Openings: Manufacturer’s standard frame formed of 0.048-inch (1.2 mm) thick, cold-rolled steel sheet; factory primed for paint.

B. Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer's standard frame formed of 0.048-inch (1.2 mm) thick, cold-rolled steel sheet; factory primed for paint with baked-enamel or powder-coated finish, and approved for use in doors of fire-protection rating indicated.

C. Metal Louvers:
   1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
      a. Air Louvers; a Division of the Activar Construction Products Group.
      b. L & L Louvers.

c. McGill Architectural Products.
d. Approved equal.

2. Blade type: Vision-proof, inverted V.
3. Metal and finish: Hot-dip galvanized steel, 0.040-inch (1.0 mm) thick, factory primed for paint with baked-enamel or powder-coated finish.
4. Metal and finish: Extruded aluminum with Class II, clear anodic finish, AA-M12C22A31.

D. Louvers for Fire-Rated Doors - Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire-protection rating of 1-1/2 hours and less:
1. Manufacturers are subject to compliance with requirements; provide products by one of the following:
a. Air Louvers; a Division of the Activar Construction Products Group.
b. L & L Louvers, Inc.
c. McGill Architectural Products.
d. Approved equal.
2. Metal and finish: Hot-dip galvanized steel, 0.040-inch (1.0 mm) thick, factory primed for paint with baked-enamel or powder-coated finish.

2.5 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated:
1. Comply with NFPA 80 requirements for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame shop drawings, BHMA-156.115-W, and hardware templates:
1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
2. Metal astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

C. Transom and Side Panels:
1. Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles:
a. Fabricate door and transom panels with full-width, solid-lumber**,** rabbeted, meeting rails. Provide factory-installed spring bolts for concealed attachment into jambs of metal door frames.

D. Openings:
1. Factory cut and trim openings through doors:
a. Light openings: Trim openings with moldings of material and profile indicated.
b. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 08 80 00: Glazing.
c. Louvers: Factory install louvers in prepared openings.

E. Exterior Doors:
1. Factory treat exterior doors with water repellent after fabrication has been completed but before shop priming or factory finishing:
a. Flash top of out-swinging doors with manufacturer's standard metal flashing.

2.6 SHOP PRIMING

A. Doors for Opaque Finish: Shop prime faces, all four edges, edges of cutouts, and mortises

with one (1) coat of wood primer specified in Section 09 90 00: Painting and Coating.

B. Doors for Transparent Finish: Shop prime faces and all four edges with stain (if required), other required pretreatments, and first coat of finish as specified in Section 09 90 00: Painting and Coating. Seal edges of cutouts and mortises with first coat of finish.

2.7 FACTORY FINISHING

A. General – For factory finish doors, factory finish doors that are indicated to receive transparent finish, and factory finish doors where indicated in schedules or on Drawings as factory finished:
   a. Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing:
      1) Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Transparent Finish:
   1. Grade: Premium.
   2. Finish: WI's Architectural Woodwork Standards System 9, UV curable, acrylated epoxy, polyester, or urethane; refer to Drawings for finish designation.
   3. Staining: As selected by Architect from manufacturer's full range.
   4. Effect: Semi-filled finish, produced by applying an additional finish coat to partially fill the wood pores.
   5. Sheen: Semigloss.

C. Opaque Finish:
   1. Grade: Premium.
   2. Finish: AWMAC's and WI's Architectural Woodwork Standards System 10, UV curable, water based; refer to Drawings for finish designation.
   3. Color: As selected by Architect from manufacturer's full range.
   4. Sheen: Semigloss.

PART 3 EXECUTION

3.1 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

3.2 EXAMINATION

A. Examine doors and installed door frames, with installer present, before hanging doors:
   1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
   2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. Hardware: For installation, see Section 08 71 00: Door Hardware.

B. Installation Instructions:
   1. Install doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated:
      a. Install fire-rated doors according to NFPA 80.
      b. Install smoke and draft-control doors according to NFPA 105.

C. Job-Fitted Doors:
   1. Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining:
      a. Clearances:
         1) Provide 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors. Provide 3/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch (6.4 mm) from bottom of door to top of threshold unless otherwise indicated:
            a) Comply with NFPA 80 for fire-rated doors.
      b. Bevel non-fire-rated doors 1/8 inch in two inches (2”) - 3-1/2 degrees - at lock and hinge edges.
      c. Bevel fire-rated doors 1/8 inch in two inches (2”) - 3-1/2 degrees- at lock edge; trim stiles and rails only to extent permitted by labeling agency.

D. Factory Fitted Doors: Align in frames for uniform clearance at each edge.

E. Factory Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.4 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 14 16

SECTION 08 31 13 ACCESS DOORS AND FRAMES

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 access doors in gypsum board, masonry partitions, and plaster/stucco soffits, where shown or required.

B. Related Sections:
1. Section 05 50 00: Metal Fabrications.
2. Section 06 10 00: Rough Carpentry.
3. Section 08 11 13: Hollow Metal Doors and Frames.
4. Section 09 21 16: Gypsum Board Assemblies.
5. Section 09 30 00: Tiling.
6. Section 09 51 00: Acoustical Ceiling Panels.

1.3 SUBMITTALS

A. Product Data:
1. Manufacturer’s literature, including schedules, charts, installation instructions, and illustrations to indicate the performance, fabrication, procedures, product variations, and accessories.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers listed whose products meet or exceed the specifications are approved for use on the Project. Other manufacturers must have a minimum of five (5) years’ experience manufacturing access doors meeting or exceeding the specifications and comply with Division 01 requirements regarding substitutions in order to be considered:
1. J. L. Industries, Commerce, CA (basis of design for rated floors).
2. Karp Associates, Inc., Melville, NY (basis of design).
3. The Bilco Company, New Haven, CT.
4. Babcock-Davis, San Lorenzo, CA.
5. Larsen’s Manufacturing Co., Minneapolis, MN.
6. Milcor, Grand Rapids, MI.
7. Approved equal.

2.2 PRODUCTS

A. Standard type flush steel access door for plaster/stucco soffit construction:
1. Size: As shown on the Drawings.
2. Hinges: Concealed continuous piano type hinges.
3. Finish: Phosphate dipped and prime coated for field painting per Section 09 90 00: Painting and Coating.
4. Frames: 16-gauge galvanized steel with 22-gauge galvanized plaster casing bead.
5. Doors: 14-gauge galvanized steel.

6. Lock: Flush screwdriver operated cam.

B. Fire Rated, Two-Hour, Floor Access Door - Flush steel door for wallboard construction:
1. Listing: UL listed, compliant to NFPA 288.
2. Size: As shown on the Drawings.
3. Hinges: Heavy-duty Type 316 stainless steel butt hinge.
4. Finish: 20-gauge galvanized [illegible] primer on exterior frame; field painting per Section 09 90 00: Painting a
5. Frames: Extruded aluminum.
6. Doors: Single leaf.
7. Lock: Knurled knob/key operated latch bolt.
8. Insulation: Two-inch (2") thick fire rated mineral fiber

NOT USED

C. Non-Rated Floor Access Door:
1. Listing: Not required.
2. Size: As shown on the Drawings.
3. Hinges: Heavy-duty Type 316 stainless steel butt hinge.
4. Finish: 20-Gauge galvanized finish with gray primer on exterior frame; field painting per Section 09 90 00: Painting and Coating.
5. Frames: 20-Gauge galvanized steel. Anchor to wood floor.
6. Doors: Single leaf.
7. Lock: Knurled knob/key operated latch bolt.
8. Hold open door.

D. Ceiling Access Door:
1. Listing: Not required.
2. Size: As shown on the Drawings.
3. Hinges: Heavy-duty Type 316 stainless steel butt hinge.
4. Finish: 20-gauge galvanized finish with gray primer on exterior frame; field painting per Section 09 90 00: Painting and Coating.
5. Frames: Extruded aluminum. Anchor to wood floor.
6. Doors: Single leaf.
7. Lock: Knurled knob/key operated latch bolt.
8. Hold open door.

PART 3 EXECUTION

3.1 INSTALLATION

A. Locate and provide access doors in walls (and floors) to construct the wall as indicated on Drawings and provide access doors and panels to fit the wall condition. Maintain designated wall types as indicated on Drawings.

3.2 LOCATIONS

A. Provide where required by code and where needed to service and maintain equipment.

B. If not shown on the Drawings, consult the Architect before locating in finished spaces.

END OF SECTION 08 31 13

SECTION 08 41 13

ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes: Requirements including but not limited to:
   1. Exterior and interior storefront framing.
   2. Exterior and interior manual swing entrance doors.
   3. Accessories necessary for a complete installation.

B. Related Sections:
   1. Section 08 80 00, Glazing.
   2. Comply with 2022 CBC Chapter

1.3 PERFORMANCE REQUIREMENTS

A. Performance: Aluminum framed systems shall withstand the effects of specified performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:
   1. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
   2. Dimensional tolerances of building frame and other adjacent construction.
   3. Failure includes the following:
      a. Deflection exceeding specified limits.
      b. Thermal stresses transferring to building structure.
      c. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.
      d. Noise or vibration created by wind and by thermal and structural movements.
      e. Loosening or weakening of fasteners, attachments, and other components.
      f. Sealant failure.
      g. Failure of operating units.

B. Structural Loads: "(For this location)"
   1. Wind Loads: Ultimate Wind Speed Gust; 101 mph. Exposure; C.

C. Deflection of Framing Members:
   1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane shall not exceed L/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch (19 mm), whichever is less.
   2. Deflection Parallel to Glazing Plane: Shall be limited to L/360 of clear span or 1/8 inch (3.2 mm), whichever is less.

D. Structural Test Performance: Provide aluminum framed systems tested according to ASTM E 330 as follows:
   1. When tested at positive and negative wind load design pressures, systems do not evidence deflection exceeding specified limits.

2. When tested at 150 percent of positive and negative wind load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity but not fewer than 10 seconds.

E. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft.0.03 L/s per sq. m of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 6.24 lbs. sq. ft. (300 Pa).

F. Water Penetration under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 8.0 lbs. sq. ft. (383 Pa).

G. Windborne Debris Impact Resistance: Pass missile impact and cyclic pressure tests when tested according to ASTM E 1886 and testing information in ASTM E 1996 for Wind Zone 4.
1. Large Missile Test: For glazed openings located within 30 feet (9.1 m) of grade.

H. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 degrees F (67 degrees C), ambient; 180 degrees F (100 degrees C), material surfaces.
2. Interior Ambient-Air Temperature: 75 degrees F (24 degrees C).

I. Condensation Resistance: Provide aluminum framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 45 when tested according to AAMA 1503.

J. Thermal Conductance: Provide aluminum framed systems with fixed glazing and framing areas having an average U-factor of not more than 0.57 Btu/sq. ft. x h x degrees F3.23 W/sq. m x K when tested according to AAMA 1503.1.

1.4 SUBMITTALS

A. Product Data: Technical data for each type of product indicated including construction details, material descriptions, dimensions of individual components and profiles, and finishes for aluminum framed systems.

B. Shop Drawings: Submit aluminum storefront framing and entrances shop drawings including plans, elevations, sections, full size details, and attachments to other Work.
1. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.
2. For entrance doors, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.

C. Entrance Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related Work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

D. Engineer’s calculations of performance requirements.

E. Maintenance Data: For aluminum framed systems to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Accessibility Requirements:
      a. California Building Code: CBC Section 11B-404.3 accessible route.
      b. U.S. Architectural and Transportation Barriers Compliance Board Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG).
      c. ICC/ANSI A117.1 Accessible and Useable Building and Facilities.
      d. CBC Section 11B-309.4 operable parts interior usage.

B. Installer Qualifications: Installer having minimum 10 years documented experience who is an authorized representative of the manufacturer and is trained and approved for installation of units required.

C. Engineering Responsibility: Prepare data for aluminum framed systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated.

D. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in service performance.
   1. Do not revise intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.

E. Source Limitations: Obtain aluminum framed entrances from single source from single manufacturer.

F. Pre-installation Conference: Conduct conference at site.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for aluminum framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1.7 WARRANTY

A. Warranty: Written warranty signed by Manufacturer, Contractor, and Installer in which manufacturer agrees to repair or replace components of aluminum framed systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including, but not limited to, excessive deflection.
      b. Noise or vibration caused by thermal movements.
      c. Water leakage through fixed glazing and framing areas.
      d. Failure of operating components.
   2. Warranty Period: Two years from date of Substantial Completion.

B. Finish Warranty: Written warranty signed by manufacturer in which manufacturer agrees to

repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering.

1. Warranty Period: 10 years from date of Substantial Completion.

1.8 MAINTENANCE SERVICE

A. Entrance Door Hardware:
   1. 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 entrance door hardware.
   2. Initial Maintenance Service: Beginning at Substantial Completion, provide six months full maintenance by skilled employees of entrance door hardware Installer. Include quarterly preventive maintenance, repair, or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper entrance door hardware operation at rated speed and capacity. Provide parts and supplies the same as those used in the manufacture and installation of original equipment.

PART 2 PRODUCTS

2.1 MATERIALS

A. Basis of Design: Arcadia AG451T, 2” x 4-1/2” Thermally broken; center glazed system, screw spline, shear block, compensating stick or punched opening fabrication for 1” glass (with compensators for ¼” glazing where required/indicated), impact resistant system, maximum design pressure +/- 45 psf. Subject to compliance with requirements, provide comparable storefront system by one of the following:
   1. Kawneer Architectural Aluminum Storefront Systems.
   2. Tubelite, Inc.
   3. US Aluminum Corporation.
   4. Vistawall.
   5. YKK America AP, Inc.

B. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
   1. Sheet and Plate: ASTM B 209ASTM B 209M.
   2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 / ASTM B 221M.
   3. Extruded Structural Pipe and Tubes: ASTM B 429.
   4. Structural Profiles: ASTM B 308 / ASTM B 308M.

C. Framing Members: Extruded aluminum framing members of thickness required and reinforced necessary to support imposed loads.
   1. Construction: Nonthermal/Thermal.
   2. Glazing System: Retained mechanically with gaskets on four sides.
   3. Glazing Plane: Center.

D. Accessories:
   1. Brackets and Reinforcements: High strength aluminum with nonstaining, nonferrous shims for aligning system components.
   2. Fasteners and Accessories: Corrosion resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
      a. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
      b. Reinforce members as required to receive fastener threads.
   3. Concrete and Masonry Inserts: Hot dip galvanized cast iron, malleable iron, or steel

inserts, complying with ASTM A 123 / A 123M or ASTM A 153 / A 153M.
4. Concealed Flashing: Corrosion resistant, non-staining, non-bleeding flashing compatible with adjacent materials.
5. Framing System Gaskets and Sealants: Recommended by manufacturer for joint type.

E. Glazing: Refer to Section 08 80 00 for impact resistant laminated glass with low-e coating on Number 2 surface.
1. Glazing Gaskets: Compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.
2. Spacers and Setting Blocks: Elastomeric type.

F. Entrance Doors: Glazed entrance doors for manual swing operation.
1. Door Construction: 1-3/4 inch 44.5 mm overall thickness, with minimum 0.125 inch3.2 mm thick, extruded aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
2. Door Design: Wide stile; 3-1/2 inch (88.9 mm) nominal width.
a. Accessible Doors: Smooth surfaced for width of door in area within 10 inches 255 mm above floor or ground plane.
3. Glazing Stops and Gaskets: Square, snap on, extruded aluminum stops and preformed gaskets.

G. Entrance Door Hardware: Refer to Section 08 71 00 for aluminum entrance hardware sets.
1. Provide entrance door hardware and entrance door hardware sets indicated in door and frame schedule for each entrance door to comply with requirements in this Section.
a. Opening-Force Requirements: CBC Section 11B-404.2.9
1) Exterior/Interior hinged doors, sliding doors or folding doors: 5 lbs. sf, Maximum.
2) Required Fire Doors: The minimum opening force allowable by DSA not to exceed 15 lbs. sf. (These forces do not apply to the force required to retract latch bolts or disengage other devices that hold the door in a closed position).
3) Accessible Interior Doors: Maximum 5 lb. ft. to fully open door.
b. Weather Stripping: Standard replaceable components to match existing.
c. Weather Sweeps: Standard exterior door bottom sweep with exposed fasteners on mounting strip to match existing.

H. Accessories:
1. Joint Sealants: For installation at perimeter of aluminum framed systems, refer to Section 07 92 00.
2. Bituminous Paint: Cold applied, asphalt mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30 mil 0.762 mm thickness per coat.

2.2 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Framing Members: Fabricate components that, when assembled, have specified characteristics:
1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system from interior to exterior.

a. Continuous sub-sill shall be provided under sill members to collect water infiltration and divert from the interior of the system.
4. Physical and thermal isolation of glazing from framing members.
5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
6. Provisions for field replacement of glazing from interior for vision glass and exterior for spandrel glazing or metal panels.
7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
8. Provide sill receptors with end dams at all sill conditions.
9. Framing members shall be internally reinforced and secured at head and sill as necessary for structural performance

C. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

D. Storefront Framing: Fabricate components for assembly using screw spline system.

E. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
1. At exterior doors, provide weather stripping at fixed stops.
2. At interior doors, provide weather stripping at stops to prevent metal to metal contact.

F. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
1. At pairs of exterior doors, provide compression type weather stripping retained in adjustable strip and mortised into door edge.
2. At exterior doors, provide weather sweeps applied to door bottoms.

G. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.3 ALUMINUM FINISHES

A. Class I, Clear Anodic Finish (Dark Bronze where indicated, 305): AA-M10C22A44, 0.018 mm or thicker.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for installation tolerances and conditions affecting performance of the Work. Proceed with installation after correcting unsatisfactory conditions.

3.2 INSTALLATION

A. Comply with aluminum framed storefront manufacturer recommended installation instructions. Coordinate installation with curtain wall work.
1. Do not install damaged components.
2. Fit joints to produce hairline joints free of burrs and distortion.
3. Rigidly secure nonmovement joints.
4. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
5. Seal joints watertight unless otherwise indicated.

B. Metal Protection:
   1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by installing nonconductive spacers as recommended by manufacturer for this purpose.
   2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

D. Set continuous sill members and flashing in full sealant bed as specified in Section 079200 to produce weathertight installation.

E. Install components plumb and true in alignment with established lines and grades, and without warp or rack.

F. Install glazing specified in Section 08 80 00.

G. Entrance Doors and Hardware: Install doors to produce smooth operation and tight fit at contact points.
   1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
   2. Field Installed Entrance Door Hardware: Install surface mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

H. Install perimeter joint sealants as specified in Section 07 92 00 to produce weathertight installation.

3.3 ERECTION TOLERANCES

A. Install aluminum framed systems to comply with the following maximum erection tolerances:
   1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet (3 mm in 3.7 m); 1/4 inch (6 mm) over total length.
   2. Alignment:
      d. Where surfaces abut in line, limit offset from true alignment to 1/16 inch1.5 mm.
      e. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch0.8 mm.

B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch3 mm.

3.4 ADJUSTING

A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer.
   1. For entrance doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches 75 mm from the latch, measured to the leading door edge.

END OF SECTION 08 41 13

SECTION 08 51 00

ALUMINUM WINDOWS

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: Requirements including but not limited to:
   1. Aluminum windows for exterior locations.
   2. Accessories necessary for a complete installation.

B. Related Sections:
   1. Section 08 80 00, Glazing.
   2. Glazing to Comply with 2022 CBC Chapter 24 Requirements.

1.3 WINDOW PERFORMANCE REQUIREMENTS

A. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440:
   1. Minimum Performance Class: AW or as indicated on Drawings.
   2. Minimum Performance Grade: 40.

B. Solar Heat Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of 0.27.

C. Condensation Resistance Factor (CRF): Provide aluminum windows tested for thermal performance according to AAMA 1503, showing a CRF of 45.

D. Thermal Movements: Provide aluminum windows, including anchorage, that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change: 120 degrees F (67 degrees C) ambient; 180 degrees F (100 degrees C) material surfaces.

E. Sound Transmission Class (STC): Rated for not less than 30 STC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 413.

F. Outside-Inside Transmission Class (OITC): Rated for not less than 22 OITC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 1332.

G. Windborne Debris Impact Resistance: Capable of resisting impact from windborne debris based on testing glazed windows identical to those specified, according to ASTM E 1886 and testing information in ASTM E 1996 and requirements of authorities having jurisdiction.

1.4 SUBMITTALS

A. Product Data: Technical data for each type of product, including construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes for aluminum windows.

B. Shop Drawings: Submit plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.

C. Samples: For each exposed product and for each color specified, 2 by 4 inches (50 by 100 mm) in size.

D. Samples: For aluminum windows and components required, showing full range of color variations for finishes, and prepared on Samples of size indicated below:
   1. Exposed Finishes: 2 by 4 inches (50 by 100 mm).
   2. Exposed Hardware: Full size units.

E. Product Schedule: Use same designations indicated on Drawings.

F. Product Test Reports: For each type of aluminum window, for tests performed by a qualified testing agency.

G. Field quality control reports.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Energy Code: Provide window units compliant with the IECC with Texas amendments,
   2. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
      a. Window Certification: AAMA certified with label attached to each window.
   3. Accessibility Requirements: Comply with applicable requirements.
      a. State of California T-24, Part I, CBC Section 11B (Accessible)
      b. U.S. Architectural and Transportation Barriers Compliance Board Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG).
      c. ICC/ANSI A117.1 Accessible and Useable Building and Facilities.

B. Manufacturer Qualifications: Manufacturer having minimum 5 years documented experience who is capable of fabricating aluminum windows that meet or exceed performance requirements indicated and of documenting the performance by test reports and calculations.

C. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.

D. Source Limitations: Obtain aluminum windows from single source from single manufacturer.

E. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
   1. Build mockup of typical wall area as shown on Drawings.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

F. Preinstallation Conference: Conduct conference at site.
   1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   2. Review and discuss the finishing of aluminum windows that is required to be coordinated with the finishing of other aluminum work for color and finish matching.
   3. Review, discuss, and coordinate the interrelationship of aluminum windows with other exterior wall components. Include provisions for anchoring, flashing, weeping, sealing perimeters, and protecting finishes.
   4. Review and discuss the sequence of work required to construct a watertight and weathertight exterior building envelope.
   5. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.

G. Preinstallation Conference: Conduct conference at site.

1.6 WARRANTY

A. Manufacturer's Warranty: Written warranty signed by Manufacturer in which manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Failure to meet performance requirements.
      b. Structural failures including excessive deflection, water leakage, condensation, and air infiltration.
      c. Faulty operation of movable sash and hardware.
      d. Deterioration of materials and finishes beyond normal weathering.
      e. Failure of insulating glass.
   2. Warranty Period:
      a. Window: 10 years from date of Substantial Completion.
      b. Glazing Units: 10 years from date of Substantial Completion.
      c. Aluminum Finish: 20 years from date of Substantial Completion.

PART 2 PRODUCTS

A. Manufacturers: Subject to compliance with requirements, provide impact resistant window products by one of the following:
   1. Arcadia, Inc. *(basis of specification).*
      a. T200 Series (thermal) Heavy Commercial Fixed, Casement, Awning and Hopper Windows, 2-inch depth.
   2. Kawneer North America; an Alcoa company.
   3. Peerless Products, Inc.
   4. Wausau Window and Wall Systems; Apogee Wausau Group.
   5. Winco Manufacturing Co.

B. Operating Types: Provide the following operating types in locations indicated on Drawings:
   1. Hopper: Project in.
   2. Awning: Project out.
   3. Single hung.
   4. Fixed.

C. Frames and Sashes: Aluminum extrusions complying with AAMA/WDMA/CSA 101/I.S.2/A440.
   1. Thermally Improved Construction: Fabricate frames, sashes, and muntins with an integral, concealed, low conductance thermal barrier located between exterior materials and window members exposed on interior side in a manner that eliminates

direct metal to metal contact.

D. Glass: Clear annealed glass, ASTM C 1036, Type 1, Class 1, q3.
   1. Kind: Fully tempered.

E. Windborne Debris Impact Resistant Laminated Glass: ASTM C 1172 with two plies of float glass.
   1. Float Glass: Fully tempered.
   2. Inner Ply: Clear.
   3. Interlayer: As required by performance requirements indicated.
   4. Outer Ply: Clear.
   5. Low-E Coating: Pyrolytic on second surface.

F. Windborne Debris Impact Resistant Insulating Glass: ASTM E 2190, factory assembled sealed glass unit units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.
   1. Sealing System: Dual seal, with polyisobutylene and silicone primary and secondary sealants.
   2. Spacer: Aluminum with black, color anodic finish.
   3. Desiccant: Molecular sieve or silica gel, or a blend of both.
   4. Overall Unit Thickness: 1 inch (25 mm).
   5. Minimum Thickness of Each Glass Lite: 6 mm.
   6. Outdoor Lite: Low E tinted float glass, impact resistant laminated glass.
   7. Interspace Content: Air.
   8. Indoor Lite: Fully tempered float glass.

G. Windborne Debris Impact Resistant Insulating Glass Units: ASTM E 2190 with two lites and complying with impact resistance requirements.
   1. Exterior Lite: ASTM C 1036, Type 1, Class 1, q3.
      a. Tint: Clear.
      b. Kind: Fully tempered.
   2. Interior Lite: ASTM C 1172 clear laminated glass with two plies of float glass.
      a. Float Glass: Fully tempered.
      b. Interlayer Thickness: Required by performance requirements indicated.
   3. Filling: Fill space between glass lites with air.
   4. Low E Coating: Pyrolytic on second surface.

H. Glazing System: Factory glazing system that produces weathertight seal.
   1. Dual Glazing System:
      a. Interior Lite: Glass.
      b. Exterior Lite: Glass.

I. Hardware: Provide hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion resistant material compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock windows, and sized to accommodate sash weight and dimensions.
   1. Exposed Hardware Color and Finish selected by Architect from manufacturer's full range.

J. Projected Window Hardware:
   1. Gear Type Rotary Operators: Complying with AAMA 901 when tested according to ASTM E 405, Method A. Provide operators that function without requiring the removal of interior screens or using screen wickets.
      a. Type and Style: Selected by Architect.
   2. Lock: Window Manufacturer.

K. Weather Stripping: Provide full perimeter weather stripping for each operable sash unless otherwise indicated.

L. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.
   1. Exposed Fasteners: Do not use exposed fasteners to greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

2.2 ACCESSORIES

A. Integral Ventilating System/Device: Where indicated, provide weather-stripped, adjustable, horizontal fresh air vent, with a free airflow slot, full width of window sash by approximately 1 inch (25 mm) when open, complying with AAMA/WDMA/CSA 101/I.S.2/A440. Equip vent bar with an integral insect screen, removable for cleaning.

B. Subsills: Thermally broken, extruded aluminum subsills in configurations indicated on Drawings.

C. Column Covers: Extruded aluminum profiles in sizes and configurations indicated on Drawings.

D. Interior Trim: Extruded aluminum profiles in sizes and configurations indicated on Drawings.

E. Panning Trim: Extruded aluminum profiles in sizes and configurations indicated on Drawings.

F. Receptor System: Two piece, snap together, thermally broken, extruded aluminum receptor system that anchors windows in place.

2.3 INSECT SCREENS

A. Fabricate insect screens to integrate with window frame. Provide screen for each operable exterior sash. Screen wickets are not permitted.

B. Aluminum Frames: Aluminum alloy complying with SMA 1004 or SMA 1201. Fabricate frames with mitered or coped joints or corner extrusions, concealed fasteners, and removable PVC spline/anchor concealing edge of frame.
   1. Tubular Framing Sections and Cross Braces: Roll formed from aluminum sheet.

2.4 FABRICATION

A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.

B. Glaze aluminum windows in the factory.

C. Weather strip each operable sash to provide weathertight installation.

D. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.

E. Provide water shed members above side-hinged sashes and similar lines of natural water penetration.

F. Mullions: Provide mullions and cover plates, matching window units, complete with anchors

for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections. Provide mullions and cover plates capable of withstanding design wind loads of window units.

G. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.

2.5 FINISH REQUIREMENTS

A. Comply with NAAMM *Metal Finishes Manual* for recommendations for applying and designating finishes.

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

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Class I, Dark Bronze Anodic Finish (305): AA-M10C22A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, dark bronze coating 0.018 mm or thicker) complying with AAMA 611.

C. Architectural Class I anodic coating conforming to AA-M12C22A31/AA-M12C22A41, Clear Finish.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the work.

B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.

C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.

D. Proceed with installation after correcting unsatisfactory conditions.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E 2112.

B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.

C. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.

D. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
   1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.

B. Testing Services: Testing and inspecting of installed windows shall take place as follows:
   1. Testing Methodology: Testing of windows for air infiltration and water resistance shall be performed according to AAMA 502.
   2. Air Infiltration Testing:
      a. Test Pressure: That required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance class indicated.
      b. Allowable Air-Leakage Rate: 1.5 times the applicable AAMA/WDMA/CSA 101/I.S.2/A440 rate for product type and performance class rounded down to one decimal place.
   3. Water Resistance Testing:
      a. Test Pressure: Two/thirds times test pressure required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance grade indicated.
      b. Allowable Water Infiltration: No water penetration.
   4. Testing Extent: One window of each type or/as selected by Architect and a qualified independent testing and inspecting agency. Windows shall be tested after perimeter sealants have cured.
   5. Test Reports: Prepared according to AAMA 502.

C. Windows will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.4 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.

B. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
   1. Keep protective films and coverings in place until final cleaning.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

D. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written instructions.

END OF SECTION 08 51 00

SECTION 08 71 00

DOOR HARDWARE

1. PART 1 GENERAL

1.1 SECTION INCLUDES

A. Hardware for doors.

B. Thresholds.

C. Gasketting.

D. Keying.

1.2 REFERENCES

A. ADA - Americans with Disabilities Act Standards for Accessible Design.

B. ANSI - American National Standards Institute.

C. BHMA - Builders' Hardware Manufacturers Association.

D. CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, California State Accessibility Standards.

E. DHI - Door and Hardware Institute.

F. DSA - Division of the State Architect.

G. NFPA 80 - Fire Doors and Windows.

H. UL - Underwriters Laboratories.

1.3 COORDINATION

A. Coordinate work of this Section with other directly affected Sections involving manufacturer of any internal reinforcement for door hardware.

1.4 QUALITY ASSURANCE

A. Manufacturers: Companies specializing in manufacturing door hardware with minimum five years experience. Obtain each kind of hardware from only one manufacturer.

B. Hardware Supplier: Company specializing in supplying commercial door hardware with five years documented experience.

C. Hardware Installer: Company specializing in the installation of commercial door hardware with five years documented experience.

D. Hardware Supplier Personnel: Employ an Architectural Hardware Consultant (AHC) to assist in the work of this Section.

1.5 REGULATORY REQUIREMENTS

A. Fire-Rated Openings: Comply with CBC Section 716 and NFPA Standard No. 80. Provide only hardware tested and listed by UL for the type and size of each door required, which complies with the requirements of the door and frame labels.

NOT USED

1. Where exit devices are required on [illegible]ovide supplementary marking on door UL label indicating "Fire Door to be Equipped with Fire Exit Hardware", and provide UL Label on exit device indicating "Fire Exit Hardware".

2. Exit device shall be compliant with State Fire Marshall Standard 12-10-3, Section 12-10-302.

B. Conform to applicable requirements of the Americans with Disabilities Act Standards for Accessible Design regarding accessibility requirements for door and entrance hardware.

C. Doors and doorways that are part of an accessible route shall comply with CBC Sections 11B-404.

D. The clear opening width for a door shall be 32 inches minimum. For a swinging door it shall be measured between the face of the door and the stop, with the door open 90 degrees. There shall be no projections into the opening below 34 inches and 4 inches maximum projections into the opening between 34 inches and 80 inches above the finish floor or ground. Door closers and stops shall be permitted to be 78 inches minimum above the finish floor or ground. CBC Section 11B-404.2.3.

E. Handles, pulls, latches, locks, and other operable parts on accessible doors shall comply with CBC Section 11B-309.4 and shall be operable with one hand and not require tight grasping, pinching, or twisting of the wrist. Operable parts of such hardware shall be 34 inches minimum and 44 inches maximum above the finish floor or ground. Where sliding doors are in the fully open position, operating hardware shall be exposed and usable from both sides. CBC Section 11B-404.2.7.

F. 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 lbs. (22.2N) maximum.

2. Required fire doors: the minimum opening force allowable by the DSA Authority, not to exceed 15 lbs. (66.7N) maximum. These forces do not apply to the force required to retract latch bolts or disengage other devices that hold the door in a closed position.

3. The force required for activating any operable parts, such as lever hardware, or disengaging other devices shall be 5 lbs. (22.2N) maximum to comply with CBC Section 11B-309.4.

G. Door closing speeds shall be as follows: CBC Section 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.

H. Thresholds shall comply with CBC Section 11B-404.2.5.

I. Floor stops shall not be located in the path of travel and 4 inches maximum from walls.

J. Hardware (including exit devices) shall not be provided with ANight Latch@ (NL) function for any accessible doors or gates unless the following conditions are met: (Such conditions must be clearly demonstrated and indicated in the specifications)

1. Such hardware has a ‘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).

K. Pair of doors: Where the tactile sign is provided at double doors with two active leafs, the sign shall be located to the right of the right hand door. CBC Section 11B-703.4.2.

L. Doors shall be capable of locking from the inside of the room when there are 5 or more occupants, as per DSA Bulletin 11-05.

1.6 SUBMITTALS

A. Submit schedule under provisions of Section 01 33 00.

B. Submit schedule at earliest possible date along with essential product data where acceptance of hardware schedule must precede fabrication of other work.

C. Organize hardware schedule into "hardware sets" indicating complete designations of every item required for each door or opening. Include the following:

1. Type, style, function, size and finish of each hardware item. Use BHMA finish codes as per ANSI A156.18.

2. Name and manufacturer of each item.

3. Fastenings and other pertinent information.

4. Location of hardware set cross-referenced to indications on Drawings both on floor plans and in door and frame schedule.

5. Explanation of all abbreviations, symbols, codes, etc., contained in schedule.

6. Mounting locations for hardware.

7. Door and frame sizes and materials.

D. Provide product data on specified hardware.

E. Keying Schedule: Submit separate detailed schedule indicating clearly how the Owner's final instructions on keying of locks has been fulfilled.

F. Furnish hardware templates to each fabricator of doors, frames, and other work to be factory-prepared for the installation of hardware.

1.7 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provisions of Section 01 77 00.

B. Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site and to other Sections under provisions of Section 01 61 00.

B. Store and protect products under provisions of Section 01 61 00.

C. Package hardware items individually; label and identify package with door opening code to match hardware schedule.

D. Deliver keys to Owner by security shipment direct from hardware supplier.

1.9 WARRANTY

A. Provide five year warranty for closers, two year warranty for all other hardware under provisions of Section 01 77 00.

1.10 MAINTENANCE MATERIALS

A. Provide special wrenches and tools applicable to each different or special hardware component.

B. Provide maintenance tools and accessories supplied by hardware component manufacturer.

2. PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

Item		Manufacturer	Acceptable Substitute	
A.	Continuous Hinges	Ives	McKinney	Hager
B.	Butt Hinges	Ives	McKinney	Hager
C.	Locksets	Corbin-Russwin	Owners standard	
D.	Cylinders	Corbin-Russwin	Owners standard	
E.	Exit Devices	Von Duprin	Owners standard	
F.	Surface Closers	LCN	Owners standard	
G.	Anti Vandal Pulls	Ives	Owners standard	
H.	Protection Plates	Trimco	Rockwood	Ives
I.	Stops and Holders	Trimco	Rockwood	Ives
J.	Overhead Stops	Glynn Johnson	Rixson	ABH
K.	Gate Boxes	Keedex	Or equal	
L.	Gate Closers	Locinox	Or equal	
M.	Thresholds/Sweeps/Seals	Pemko	Reese	NGP

2.2 MATERIALS

A. Locksets: Cylindrical type. 16 gage curved steel, bronze or brass strikes with 2 inch deep box construction, with curved lips of sufficient length to clear trim and protect clothing.

1. Comply with requirements of local security ordinances.

2. Locks shall be of such construction that when locked, the door may be opened from within by using lever and without the use of a key or special knowledge.

3. Lock series and design: Corbin-Russwin CL3300 series NZD lever.

B. Butt Hinges: Outswinging exterior doors shall have non-removable (NRP) pin. Hinge open widths shall be minimum, but of sufficient size to permit door to swing 180 degrees. Furnish hinges with stainless steel pins and ball bearings.

1. Furnish 3 hinges per leaf to 7'-5" height. Add one for each additional 2 foot height.

2. Provide 5 inch heavy weight hinges on doors over 3'-4" width.

C. Continuous Hinges: Hinge open widths shall be minimum, but of sufficient size to permit door to swing 180 degrees. Where necessary to maintain door clearance at jamb trim, frame conditions, door reveals and similar conditions, furnish wide throw hinges as approved by the Architect. Where door is indicated as having fire resistance rating, provide UL listed and labeled hardware.

D. Panic Hardware: Furnish exit devices with sex bolts at wood doors. Lever handle trim shall match locksets. Device shall bear UL label for fire and or panic as may be required.

1. Provide glass bead kits of proper thickness where the rail assembly of the exit device crosses a lite.

E. Surface Door Closers: Full rack and pinion type with removable non-ferrous case. Provide closers with sex bolts and grommets at wood doors. Place closers inside building, stairs, rooms, etc. Closers shall be non-handed, non-sized and adjustable. Closers shall be installed to permit door to swing 180 degrees.

1. Flush transom offset brackets shall be used where parallel arm closers are listed for doors with fixed panels over.

2. Provide drop brackets, shoe supports, and blade stop spacers as required at narrow top rails.

F. Protection Plates: Fabricate either kick, armor, or mop plates with four beveled edges, height called for in schedule by width of door less 2 inches. Furnish with machine or wood screws of bronze or stainless steel to match other hardware.

G. Floor Stops: Floor mounted door stops are prohibited where located in the path of travel. Where provided, install maximum 4 inches from wall surface.

H. Seals: Solid neoprene to be MIL Spec. R6855-CL III, Grade 40. Sponge neoprene to be MIL Spec. R6130, Type II, Group C. UL label shall be applied on all rated doors.

I. Silencers: Furnish silencers for interior hollow metal frames, 3 for single doors, 2 for pairs of doors. Omit where sound or light seals occur, or for fire-resistive-rated door assemblies.

J. Thresholds: Change in level between 1/4 inch and 1/2 inch shall be beveled with a slope no greater that 1 unit vertical to 2 units horizontal (50 percent slope). The floor or landing shall not be more that 1/2 inch lower than the threshold of the doorway.

2.3 KEYING

A. Contact the District Locksmith with Westminster School District (714-894-7311) for keying requirements. Keying system shall be coordinated with the Owner and approved by Owner's representative in writing. Furnish construction key system in accordance with lock manufacturers' standard. Where interchangeable core systems are used, provide temporary cores for construction keying.

B. Key system shall be Corbin-Russwin, LFIC cylinders, 6-pin.

C. For protection of the Owner, key cylinders at the factory of the cylinder manufacturer where permanent records are maintained. Permanently inscribe each key with number that identifies cylinder manufacturer key symbol, and notation 'DO NOT DUPLICATE".

D. Deliver permanent keys and cylinder cores directly to Owner by registered security shipment direct from hardware manufacturer. Hardware supplier shall not cut keys.

2.4 LOCK BOX

A. Model No. 3200 lock box manufactured by the Knox Company, www.knoxbox.com..

B. Surface or recess mounted as required.

C. Polyester powder coated finish in black color.

D. UL listed tamper switch.

2.5 FINISHES

A. Generally to be BHMA 626 Satin Chromium.

B. Areas using BHMA 626 shall have push, pulls and kick plates of BHMA 630, Satin Stainless Steel, unless otherwise noted.

C. Factory paint door closers to match other hardware, unless otherwise noted.

D. Aluminum items to be finished AL unless otherwise noted.

2.6 FASTENERS

A. Screws for strikes, face plates and similar items shall be flathead, countersunk type; provide machine screws for metal and standard wood screws for wood.

B. Screws for butt hinges shall be flathead, countersunk, full-thread type.

C. Fastening of closer bases or closer shoes to doors shall be by means of sex bolts and spray painted to match closer finish.

D. Provide expansion anchors for attaching hardware items to concrete or masonry.

E. All exposed fasteners shall have a phillips head.

F. Finish of exposed screws to match surface finish of hardware or other adjacent work.

2.7 OTHER MATERIAL

A. All other materials not specifically described, but required for a complete and proper finish hardware installation shall be selected by Architect as required at no additional cost.

3. PART 3 EXECUTION

3.1 INSPECTION

A. Verify that doors and frames are ready to receive work and dimensions are as instructed by the manufacturer.

B. Verify that power supply is available to power operated devices.

C. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION

A. Pre-Installation Meetings: Initiate and conduct with supplier, installer, and related trades, coordinate materials and techniques, and sequence complex hardware items and systems installation. Include manufacturers' representatives of locks, panic hardware, and door closers in the meetings. Convene at least one week prior to commencement of related work.

B. Install hardware in accordance with manufacturer's instructions and requirements of DHI.

C. Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted or finished in another way, coordinate removal, storage and reinstallation or application of surface protection with finishing work specified in Division 9. Do not install surface-mounted items until finishes have been completed on the substrate.

D. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

E. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

F. Set exterior door thresholds with full-width bead of elastomeric sealant on each point of contact with floor, providing a continuous weather seal. Anchor thresholds with stainless steel countersunk screws.

G. If handle of door is changed during construction, make necessary changes in hardware at no additional cost.

H. Mount lock box in accordance with manufacturers' instructions. Connect to building security system. Mount at 4'-0" from finished grade to center of box.

3.3 ADJUST AND CLEAN

A. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.

B. Clean adjacent surfaces soiled by hardware installation.

C. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy of a space or area, return to the work during the week prior to acceptance or occupancy, and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

D. Instruct Owner's Personnel in proper adjustment and maintenance of hardware finishes, during the final adjustment of hardware.

E. Continued Maintenance Service: Approximately six months after the completion of the project, the Contractor, accompanied by the Finish Hardware Installer, shall return to the project and re-adjust every item of hardware to restore proper function of doors and hardware. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures. Replace hardware items which have deteriorated or failed due to

faulty design, materials or installation of hardware units. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware.

3.4 HARDWARE LOCATIONS

A. Lockset: 34 to 44 inches above finished floor. Verify manufacturers' template with door design.

B. Door Pull: 40 inches from bottom of door to center of pull.

C. Panic Device: 36 to 44 inches above finished floor. Verify manufacturers' template with door design.

D. Conform to CBC, CCR, Title 24, Part 2, and ADA regarding positioning requirements for accessibility.

3.5 FIELD QUALITY CONTROL

A. Architectural Hardware Consultant (AHC) to inspect installation and certify that hardware and its installation have been furnished and installed in accordance with manufacturer's instructions and as specified herein.

3.6 SCHEDULE

A. Legend of listed manufacturers. The last column in the Schedule of Door Hardware refers to the manufacturer listed in the following schedule:

COR	Corbin-Russwin
GLY	Glynn Johnson
IVE	Ives
KEE	Keedex
LCN	LCN
LOC	Locinox
PEM	Pemko
TRM	Trimco
VON	Von Duprin

B. The items listed in the following schedule shall conform to the requirements of the foregoing specification.

C. The Door Schedule on the Drawings indicates which hardware set is used with each door.

D. Schedule of Door Hardware:

HW-1
Each single door to have

1	CONTINUOUS HINGE	112HD	628	IVE
1	EXIT DEVICE	AX-PA-CD-98NL-OP x 110NL x 1439	626	VON
1	MORTISE CYLINDER	1080-CT6	626	COR
1	RIM CYLINDER	3080-CT6	626	COR
2	PERMANENT CORE	8000	626	COR
1	ANTI VANDAL PULL	VR910NL	630	IVE
1	SURFACE CLOSER	4040XP-SCUSH	689	LCN
1	MOUNTING BRACKET	4040XP-30	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1 SET	DOOR SEALS	BY FRAME MFR	---	---
1	DOOR SWEEP	57V	628	PEM
1	THRESHOLD	PER SILL DETAIL	628	PEM

HW-2
Each single door to have

1	CONTINUOUS HINGE	112HD	628	IVE
1	EXIT DEVICE	AX-PA-CD-98NL-OP x 110NL x 1439	626	VON
1	MORTISE CYLINDER	1080-CT6	626	COR
1	RIM CYLINDER	3080-CT6	626	COR
2	PERMANENT CORE	8000	626	COR
1	ANTI VANDAL PULL	VR910NL	630	IVE
1	SURFACE CLOSER	4040XP-SHCUSH	689	LCN
1	MOUNTING BRACKET	4040XP-30	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1 SET	DOOR SEALS	BY FRAME MFR	---	---
1	DOOR SWEEP	57V	628	PEM
1	THRESHOLD	PER SILL DETAIL	628	PEM

HW-3
Each pair door to have

2	CONTINUOUS HINGE	112HD	628	IVE
1	REMOVABLE MULLION	KR4954 x MT54	689	VON
1	EXIT DEVICE	AX-PA-CD-98NL-OP x 110NL	626	VON
1	EXIT DEVICE	AX-PA-CD-98EO	626	VON
3	MORTISE CYLINDER	1080-CT6	626	COR
1	RIM CYLINDER	3080-CT6	626	COR
4	PERMANENT CORE	8000	626	COR
1	ANTI VANDAL PULL	VR910NL	630	IVE
1	ANTI VANDAL PULL	VR910DT	630	IVE
2	SURFACE CLOSER	4040XP-SCUSH	689	LCN
2	MOUNTING BRACKET	4040XP-30	689	LCN
2	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	MULLION SEAL	5110	BLK	PEM
1 SET	DOOR SEALS	BY FRAME MFR	---	---
2	DOOR SWEEP	57V	628	PEM
1	THRESHOLD	PER SILL DETAIL	628	PEM

HW-4
Each single door to have

3	HINGE	5BB1 - 4.5 x 4.5	652	IVE
1	LATCHSET	CL3310-NZD-M17	626	COR
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	OVERHEAD STOP	450S	630	GLY
3	SILENCERS	1229A	GRY	TRM
1	THRESHOLD	PER SILL DETAIL	---	---

HW-5
Each single door to have

3	HINGE	5BB1 - 4.5 x 4.5	652	IVE
1	LOCKSET	CL3355-NZD-M17-CT6	626	COR
1	PERMANENT CORE	8000	626	COR

1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1	OVERHEAD STOP	450S	630	GLY
3	SILENCERS	1229A	GRY	TRM
1	THRESHOLD	PER SILL DETAIL	628	PEM

HW-SG1
Each pair gate to have

2 SET	GATE HINGE/CLOSER	MAMMOTH-180	BLK	LOC
1	REMOVABLE MULLION	KR4954 x 050092-00	689	VON
1	EXIT DEVICE	AX-PA-CD-98NL-OP x WH	626	VON
1	EXIT DEVICE	AX-PA-CD-98EO x WH	626	VON
3	MORTISE CYLINDER	1080-CT6	626	COR
1	RIM CYLINDER	3080-CT6	626	COR
4	PERMANENT CORE	8000	626	COR
1	ANTI VANDAL PULL	VR910NL	630	IVE
1	ANTI VANDAL PULL	VR910DT	630	IVE
2	GATE BOX	K-BXED-V992L-2	600	KEE
Note:	Balance of material provided by Tube Steel Gate Manufacturer			

HW-6
Each single door to have

1	CONTINUOUS HINGE	112HD	628	IVE
1	MORTISE CYLINDER	1080-CT6	626	COR
1	RIM CYLINDER	3080-CT6	626	COR
2	PERMANENT CORE	8000	626	COR
1	ANTI VANDAL PULL	VR910NL	630	IVE
1	SURFACE CLOSER	4040XP-SCUSH	689	LCN
1	MOUNTING BRACKET	4040XP-30	689	LCN
1	KICK PLATE	K0050 - 10 x 2 LDW x B4E	630	TRM
1 SET	DOOR SEALS	BY FRAME MFR	---	---
1	DOOR SWEEP	57V	628	PEM
1	THRESHOLD	PER SILL DETAIL	628	PEM

END OF SECTION

SECTION 08 80 00

GLAZING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes: Requirements including but not limited to:
1. Tempered glass.
2. Reflective glass.
3. Glazing sealants.
4. Fire rated glass and sealants
5. Accessories necessary for a complete installation.

B. Related Sections:
1. Section 08 11 13, Hollow Metal Doors and Frames.
2. Section 08 14 16, Flush Wood Doors.
3. Section 08 51 00, Aluminum Windows.
4. Section 08 41 13, Aluminum-Framed Entrances and Storefronts.

1.2 DEFINITIONS

A. Glass Thickness: Indicated by thickness designations in millimeters according to ASTM C 1036.

B. Interspace: Space between lites of an insulating lass unit.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design glass panels including comprehensive engineering analysis by a qualified professional engineer lawfully licensed in the State of California, using performance requirements and design criteria indicated.

B. Installed Glazing: Design glazing systems to withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the CBC and ASTM E 1300.
1. Design Wind Pressures: Indicated on Drawings.
2. Design Wind Pressures: Determine design wind pressures applicable to Project according to ASCE/SEI 7, based on heights above grade indicated on Drawings.
   a. Wind Design Data: As indicated on Drawings.
   b. Basic Wind Speed: 110 mph (49 m/s). Or as indicated on structural drawings.

c. Importance Factor: 1.0.
3. Exposure Category: C.
4. Design Snow Loads: Indicated on Drawings.
5. Thickness of Patterned Glass: Base design of patterned glass on thickness at thinnest part of the glass.
6. Probability of Breakage for Sloped Glazing: For glass surfaces sloped more than 15 degrees from vertical, design glass for a probability of breakage not greater than 0.001.
7. Maximum Lateral Deflection: For glass supported on all four edges, the center of glass deflection limit at design wind pressure shall be not more than 1/50 times the short side length or 1 inch (25 mm), whichever is less.

D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

E. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
1. For monolithic glass lites, properties are based on units with lites 6 mm thick.
2. For laminated glass lites, properties are based on products of construction indicated.
3. For insulating glass units, properties are based on units of thickness indicated for overall unit and for each lite.
4. U-Factors: Center of glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg. F (W/sq. m x K).
5. Solar Heat Gain Coefficient and Visible Transmittance: Center of glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

1.4 SUBMITTALS

A. Product Data: Technical data for each type of product including recommended installation and cleaning procedures.

B. Glass Samples: For each type of glass required. Prepare samples from same material to be used for Work.

C. Glazing Schedule: List glass types and thickness for each size opening and location. Use same designations indicated here-in and on Drawings.

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

E. Product Certificates: Submit glass product certificates required by Code.
1. Glass Manufacturer Certificate: The glass manufacturer shall submit a letter certifying it has reviewed the glazing details proposed for the project, including the use of gaskets and sealants, and that each product furnished is recommended for the application shown and compliance with the Code.

F. Thermal Stress and Wind Load Analyses: Submit the following from the glass manufacturer:
1. Thermal stress analysis for each exterior glass unit type, each building elevation. The analysis shall clearly indicate the expected service temperature ranges and the effects of partial and full shading on the glass.
a. Attach to the thermal stress analysis a statement from the glass manufacturer that based upon this analysis that the resulting thermal stresses will not reduce the

specified statistical probability of breakage.

2. Wind load analysis for each glass unit type, each building elevation. The analysis shall indicate the statistical probability of breakage at the design wind pressure does not exceed the specified statistical probability of breakage.

G. Product Test Reports: Submit test reports for insulating glass and glazing sealants, for tests performed by a qualified testing agency.
   1. Glazing Sealants: Provide test reports based on testing current sealant formulations within previous 36 month period.
   2. Glazing Sealants: Preconstruction adhesion and compatibility test report.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Building Code: Comply with applicable requirements for glazing in CBC 2022 California Building Code (CCR Title 24, Part 2, as adopted and amended by DSA).
   2. Energy Code: Comply with applicable requirements of glazing in the 2022 California Green Building Standards Code California Code of Regulations, Title 24, Part 11.
   3. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
      a. As a minimum provide Category II materials complying with testing requirements in 16 CFR 1201 (Consumer Product Safety Commission *Safety Standard for Architectural Glazing Materials*, published in the Code of Federal Regulations) and ANSI Z97.1.
      b. Permanently mark safety glass with certification label of Safety Glazing Certification Council.
   4. Insulating Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.
   5. Glazing Publications: Comply with published recommendations of glass product organizations.
      a. GANA: Glazing Manual.
      b. IGMA: SIGMA TM-3000 Vertical Glazing Guidelines.
      c. GANA: Laminated Glazing Reference Manual.
      d. AAMA: AAMA GDSG-1 Glass Design for Sloped Glazing.
      e. AAMA: TIR A7 Sloped Glazing Guidelines.
      f. IGMA for Sloped Glazing: IGMA TB-3001 Guidelines for Sloped Glazing.
      g. IGMA for Insulating Glass: SIGMA TM-3000 North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use.
   6. Fire Rated Door Assemblies: Assemblies complying with NFPA 80 listed and labeled by UL for fire ratings indicated, based on testing according to NFPA 252.
   7. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.
      a. Minimum Glass Thickness for Exterior Lites: 1/4 inch (6 mm).
      b. Thickness of Tinted Glass: Provide same thickness for each tint color indicated.
   8. Strength: Where annealed float glass is indicated, provide annealed float glass, heat strengthened float glass, or fully tempered float glass necessary to comply with performance requirements.
      a. Where heat strengthened float glass is indicated, provide heat strengthened float glass or fully tempered float glass necessary to comply with performance requirements.
      b. Where fully tempered float glass is indicated, provide fully tempered float glass.

B. Installer Qualifications, Glazer: Experience entity having minimum 5 years documented experience and who employs glass installers certified under the National Glass

Association's Certified Glass Installer Program.

C. Installer Qualifications, Decorative Film: Experience entity having minimum 5 years documented experience in the installation of glass films.

D. Source Limitations for Glass and Glass Accessories: Obtain each type of glass and glass accessories from a single source.

E. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

F. Pre-installation Conference: Conduct conference at site.

G. Fire Protective Rated Glass: Each lite shall bear permanent, non-removable label of UL certifying it for use in tested and rated fire protective assemblies.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Delivery: Deliver materials in manufacturer’s original, unopened, undamaged containers with identification labels intact.

C. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by manufacturer.

D. Exercise exceptional care to prevent edge damage to glass, and damage/deterioration to coating on glass.

E. Comply with insulating glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
   1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 degrees F (4.4 degrees C).

B. Field Measurements: Verify actual dimensions of openings and construction contiguous with decorative glass by field measurements before fabrication.

1.8 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.9 WARRANTY

A. Coated Glass Products: Written warranty signed by manufacturer in which glass manufacturer agrees to replace coated glass units that deteriorate within specified warranty

period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
1. Warranty Period: Ten (10) years from date of Substantial Completion.

B. Insulating Glass: Written warranty signed by manufacturer in which manufacturer agrees to replace insulating glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
1. Warranty Period: Ten (10) years from date of Substantial Completion.

C. Glass Film: Written warranty signed by glass film manufacturer and installer in which manufacturer and installer agree to replace glass film that crack, peel, delaminate, discolor, change appearance, or failure to meet solar criteria within specified warranty period.
1. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MATERIALS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Glass:
   a. Cardinal Glass Industries.
   b. AGC Glass Company North America, Inc.
   c. Cardinal Glass Industries.
   d. Guardian Industries Corp.; SunGuard.
   e. Oldcastle Building Envelope.
   f. Pilkington North America.
   g. Vitro Architectural Glass.
   h. Vetrotech Saint-Gobain.
2. Glass Film:
   a. 3M Construction Markets Division. http://www.3m.com
   b. Bekaert Specialty Films. http://www.solargard.com
   c. Madico. http://www.madico.com

B. Clear Annealed Float Glass: ASTM C 1036, Type I, Class 1 (clear), Quality-Q3.

C. Ultra-clear Float Glass: ASTM C 1036, Type I, Class I (clear), Quality-Q3; and with visible light transmission of not less than 91 percent and solar heat gain coefficient of not less than 0.87.

D. Tinted Annealed Float Glass: ASTM C 1036, Type I, Class 2 (tinted), Quality-Q3.

E. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
1. Fabrication Process: By horizontal (roller hearth) process with roll wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

F. Laminated Float Glass: ASTM 1036 / ASTM C1172 / ASTM C1376, Kind LT (fully tempered and bonded by an interlayer), Condition A (uncoated) unless otherwise indicated, Class 1

(clear) and/or Class 2 (tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller hearth) process with roll wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

G. Pyrolytic Coated, Low Maintenance Glass: Clear float glass with a coating on first surface having both photocatalytic and hydrophilic properties that act to loosen dirt and to cause water to sheet evenly over the glass instead of beading.

H. Ceramic Coated Vision Glass: ASTM C 1048, Condition C, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3; and complying with Specification No. 95-1-31 in GANA *Engineering Standards Manual*.

I. Reflective Coated Vision Glass: ASTM C 1376.

J. Ceramic Coating Color: Selected by Architect from manufacturer's full range.

K. Adhered Backing: Adhered scrim backing to ceramic coated surface; provide backed units identical to materials which, while possibly developing cracks and fissures, show no shear nor develop any openings large enough for the unobstructed penetration of 3 inch diameter sphere when tested by approved independent testing laboratory:

1. Mount test specimens consisting of 3 glass assemblies, 34" x 76" (plus zero or minus 3/16 inch), for testing as specified in ANSI Z-97.1.
2. Expose specimens to 100 cycles of the following conditions:
   a. 1 hour at 0 degrees F, ambient humidity.
   b. 3 hours increase from 0 degrees F to 140 degrees F, 95 to 100 percent relative humidity.
   c. 1 hour at 140 degrees F, 95 to 100 percent relative humidity.
   d. 3 hours decrease from 140 degrees F to 0 degrees F, ambient humidity.
3. Break glass by spring-loaded prick punch at midpoint of either vertical edge.
4. After breaking glass, subject it to pressure of 4 lbs. per sq. ft. for 5 minutes to simulate wind load.
5. Inorganic Opacifier: Provide polyethylene opacifier where no insulation and other backing material is applied directly to spandrel glass. Use polyester where direct attachment does occur.
6. Fallout Resistance: Provide spandrel units identical to those passing fallout resistance test for spandrel glass specified in ASTM C 1048.

2.2 FIRE RATED GLAZING

A. Manufacturer: FireLite® as manufactured by Nippon Electric Glass Company, Ltd., and distributed by Technical Glass Products, 8107 Bracken Place SE, Snoqualmie, WA 98065 phone (800.426.0279) fax (425.396.8300) e-mail sales@fireglass.com, web site http://www.fireglass.com

B. Passes positive pressure test standards UL 10C

NOT USED

C. Labeling: Permanently label each piece of FireLite® with the FireLite® logo, UL logo and fire rating in sizes up to 3,325 sq. in., and with the FireLite® label only for sizes that exceed the listing (as approved by the local authority having jurisdiction).

D. Fire Rating: Fire rating classified and labeled by UL for fire rating scheduled at opening locations on drawings, when tested in accordance with ASTM E2010-01, NFPA 257, UL 9 and UL 10B.

2.3 INSULATING GLASS

A. Insulating Glass Units: Factory assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.

B. Sealing System: Dual seal, with polyisobutylene and silicone primary and secondary sealants.
   1. Spacer: Aluminum with black, color anodic finish. Thermally broken aluminum.
      a. Manufacturers: Subject to compliance with requirements, provide products by Technoform Glass Insulation NA, Inc.
      b. Desiccant: Molecular sieve or silica gel, or a blend of both.

C. Performance Properties:
   1. Basis of Design Product: <Insert manufacturer's name; product name or designation>.
   2. Overall Unit Thickness: 1 inch (25 mm).
   3. Minimum Thickness of Each Glass Lite: 1/4 inch (6 mm).
   4. Outdoor Lite: Fully tempered float glass.
   5. Interspace Content: Air.
   6. Indoor Lite: Fully tempered float glass.
   7. Safety glazing required.

2.4 GLASS FILM

A. Performance Requirements:
   1. Scratch resistant coating that, after fully cured, facilitates cleaning without damaging or scratching film.
   2. Optical Distortion: When viewed from a distance of 10 feet at angles up to 45 degrees from either side of the glass, there is no discernable distortion.
   3. Edges: Seal edges except when the film is applied with a lacquer that prevents moisture or free water from penetrating between the film and the glass.

B. Coating: Provide coating with uniform finish, without noticeable pin holes, streaks, thin spots, scratches, or banding.
   1. Light Transmission:
      a. Maximum Variation across Width and Length: Not to exceed 1 percent.
      b. Variation *in Transmission across Width and Length: Not to exceed 2 percent.*

C. Rate of Change of Total Transmission across Width and Length: Not to exceed 1 percent in 4 inches.

2.5 GLAZING ACCESSORIES

A. Compatibility: Provide glazing sealants compatible with one another and with other materials in contact, including glass products, seals of insulating glass units, and glazing channel substrates, under conditions of service and application, demonstrated by sealant manufacturer based on testing and field experience.

B. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.

C. Colors of Exposed Glazing Sealants: Selected by Architect.

D. Glazing Sealant: Neutral curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Dow Corning Corporation.
      b. GE Construction Sealants; Momentive Performance Materials Inc.
      c. May National Associates, Inc.; a subsidiary of Sika Corporation.
      d. Pecora Corporation.
      e. Sika Corporation.

E. Back Bedding Mastic Glazing Tapes: Preformed, butyl based, 100 percent solids elastomeric tape; non-staining and non-migrating in contact with nonporous surfaces; with or without spacer rod recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
   1. AAMA 804.3 tape, where indicated.
   2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
   3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

F. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
   1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
   2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

G. Miscellaneous Glazing Accessories: Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with proven record of compatibility with surfaces contacted in installation.
   1. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
   2. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
   3. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
   4. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
   5. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.
   6. Perimeter Insulation for Fire Resistive Glazing: Product approved by testing agency listed and labeled fire resistant glazing product with which it is used for application and fire protection rating indicated.

~~2.6~~ **GLAZING COMPOUND FOR FIRE-RATED GLAZING MATERIALS (G5.1)**

~~A. Glazing Tape: Closed cell polyvinyl chloride (PVC) foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2 percent. Glass panels that exceed 1,393 sq. inch~~ NOT USED ~~ratings must be glazed with fire-rated glazing tape supplied by manufacturer.~~

~~B. Glazing Compound: DAP 33 putty.~~

C. [Silicone Sealant: One-part neutral curing silicone, medium modulus sealant, Type S; Grade NS; Class 25 with additional movement capability of 50 percent in both extension and compression (total 100 percent); Use (Exposure) NT; Uses (Substrates) G, A, and O as applicable. Available Products:
   1. Dow Corning 795 - Dow Cor
   2. Silglaze-II 2800 - General El
   3. Spectrem 2 - Tremco Inc.

NOT USED

D. Setting Blocks: Neoprene, EPDM, or silicone; tested for compatibility with glazing compound; of 70 to 90 Shore A hardness.

2.7 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
   1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
      a. Temperature Change: 120 degrees F (67 degrees C), ambient; 180 degrees F (100 degrees C), material surfaces.
   2. Edge and Surface Conditions: Comply with the recommendations of AAMA *Structural Properties of Glass* for clean cut edges, except comply with manufacturer's recommendations.
   3. Exposed Glass Edges and Surface Condition: Finish edges flat with an arrissed edge profile (small bevel of uniform width not exceeding 1.5 mm at an angle of approximately 45 degrees to the surface of the glass) with polished (surface is reflective in appearance similar to the major surface of the glass) surface.

B. Cutting: Wheel cut or sawed edges and seamed at manufacturer's option. For site cut glass, provide glass 2 inches (50.8 mm) larger than required in both dimensions to facilitate cutting of clean cut edges without the necessity of seaming or nipping. Do not cut, seam, nip or abrade heat treated glass.

C. Butt Glazing: Clean cut or flat grind vertical edges of butt glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
   1. Edges: Grind smooth and polish exposed glass edges and corners.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
   1. Manufacturing and installation tolerances, including size, squareness, and offsets at corners.
   2. Presence and functioning of weep systems.
   3. Minimum required face and edge clearances.
   4. Effective sealing between joints of glass-framing members.

B. Proceed with installation after correcting unsatisfactory conditions.

3.2 PREPARATION

A. Clean glazing channels and framing members receiving glass immediately before glazing.

Remove coatings not firmly bonded to substrates.

1. Comply with manufacturer instructions for wiping of surfaces immediately before application of primers.
2. Wipe metal surfaces with IPA (isopropyl alcohol) unless otherwise required by compatibility and adhesion testing results.

B. Inspect each piece of glass immediately before installation. Do not install pieces improperly sized or with damaged edges, scratches, abrasion, or evidence damage. Remove labels from glass immediately after installation.

C. Examine glazing units to locate exterior and interior surfaces. Label or mark units so exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

D. Seal vent (breather or capillary) tubes in insulating glass units in accordance with insulating glass manufacturer written recommendations.

E. Glass Film Preparation:

1. Remove particulate matter on the glass surface using a scraping blade.
2. Place an absorbent towel on window sill or sash to absorb moisture generated by the film application.

3.3 GLAZING

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8 inch (3 mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

J. Where wedge shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
   1. Square cut wedge shaped gaskets at corners and install gaskets as recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

K. Tape Glazing: Position tapes on fixed stops so that, when compressed by glass, the exposed edges are flush with or protrude slightly above sightline of stops.
   1. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make tapes fit opening.
   2. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.
   3. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
   4. Do not remove release paper from tape until right before each glazing unit is installed.
   5. Apply heel bead of elastomeric sealant.
   6. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
   7. Apply cap bead of elastomeric sealant over exposed edge of tape.

L. Gasket Glazing (Dry): Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
   1. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
   2. Installation with Drive in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
   3. Installation with Pressure Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
   4. Install gaskets to protrude past face of glazing stops.

M. Sealant Glazing (Wet): Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
   1. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
   2. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

N. Erection Tolerances:
   1. Maximum Deviation from Vertical: 1/8 inch in any story and 1/4 inch in any 45 foot run.

2. Maximum Deviation from Horizontal: 1/8 inch in any 30 foot run.
3. Maximum Deviation from True Alignment: 1/32 inch for any two (2) abutting units. Allow no edge projections.
4. Maximum Joint Gap: 1/32 inch.

3.4 CLEANING AND PROTECTION

A. Immediately after installation remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
   1. If contaminating substances come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

PART 4 SCHEDULE

4.1 GLAZING SCHEDULE

A. **G-1 Insulated Glass:** 1 inch (25 mm) sealed insulated unit consisting of an exterior lite of 1/4 inch (6 mm) low-e tinted tempered float glass, 1/2 inch gas filled air space, and 1/4 inch (6 mm) clear tempered float glass interior lite.

B. **G-2 Tinted Tempered Glass:** 1/4 inch (6 mm) tinted tempered glass.

C. **G-3 Clear Tempered Glass:** 1/4 inch (6 mm) clear tempered float glass.

D. G-4 Annealed Float Glass: *Not Used.*

E. G-5 20 min. Fire Rated Glass: *Not Used*

F. **G-5.1 90 min. Fire Rated Glass:** 3/16" inch (5 mm) ceramic, premium clear fire rated glass; 90 minute UL 377. All test performed in accordance with UL 9, UL 10C, NFPA 80, NFPA 257.

NOT USED

G. G-6 Acoustic Glazing: *Not Used*

H. G-7 Laminated Glass: *Not Used*

I. G-10 Insulated Spandrel Glass: *Not Used*

END OF SECTION 08 80 00

SECTION 09 21 16

GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes: Requirements including but not limited to:
   1. Gypsum Board.
   2. Exterior Gypsum Board for Ceilings and Soffits.
   3. Reinforced Gypsum Board Sheathing (Tile Backer Board).
   4. Cementitious Backer Units.
   5. Sound Attenuation Insulation.
   6. Exterior gypsum board sheathing.
   7. Accessories necessary for a complete installation.

1.3 RELATED SECTIONS

A. Section 03 30 00: Cast-In-Place Concrete.

B. Section 05 40 00: Cold Formed Metal Framing.

C. Section 09 30 00: Tiling.

1.4 PERFORMANCE REQUIREMENTS

A. Performance Requirements: Comply with manufacturer's load tables and the following design pressures and deflections:
   1. Stairs, Elevator Hoistways, and Vertical Shafts: 1/120 at 10 psf.
   2. Partitions Receiving Lath and Plaster: 1/360 at 15 psf.
   3. Partitions Receiving Monitors, Televisions, Heavy Audio/Visual Equipment: 1/360 at 15 psf.
   4. Typical Partitions: 1/240 at 5 psf.
   5. Other Partitions: 1/240 at 5 psf.
      a. Maximum Deflection:
         1) L/240 at 5 lbf per sq. ft.
         2) L/120 at 5 lbf per sq. ft.
         3) L/120 at 7.5 lbf per sq. ft.
         4) L/120 at 10 lbf per sq. ft.

B. Fire Resistance Rated Assemblies: For fire resistance rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

C. STC Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

1.5 SUBMITTALS

A. Product Data: Submit For each type of drywall including calculations for loadings and stresses of exterior walls and specially fabricated framing based on manufacturer's load tables.

B. Shop Drawings: Indicate 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:
1. Trim Accessories: Full size Sample in 12 inch (300 mm) long length for each trim accessory indicated.
2. Textured Finishes: 12 inch by 12 inch (300 mm by 300 mm) for each textured finish indicated and on same backing indicated for Work.

D. Calculations: Submit calculations verifying steel partition stud minimum base metal thickness and depth compliance with Code and ASTM C645 for height, load, and deflection.

E. Evaluation Reports: ICC-ES reports for dimpled steel studs and runners and firestop tracks.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements:
1. CBC 2022 California Building Code. CCR Title 24, Part 2, as adopted and amended by DSA.
   a. CBC-7 – Chapter 7, Fire Resistant Materials and Construction
   b. CBC-19A – Chapter 19A, Concrete
   c. CBC – Chapter 25, Gypsum Board and Plaster.

2. Division of the State Architect, Interpretation of Regulations (DSA-IR)
   a. DSA-IR 25-3, Drywall Ceiling Suspension Conventional Construction-One Layer.
   b. DSA-IR 25-5.13, Metal Suspension Systems for Lay in Panel Ceilings.

3. Fire Resistance Rated Assemblies: For fire resistance rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
4. All gypsum boards to be mildew and mold resistant, with a score of 10 on ASTM D3273.

B. Single Source Responsibility:
1. Framing Members: Obtain steel framing members from single manufacturer.
2. Panel Products: Obtain each type of gypsum board and other panel products from single manufacturer.
3. Finishing Materials: To the extent possible, obtain finishing materials from same manufacturer supplying gypsum board products. When not possible, obtain materials from manufacturer acceptable to gypsum board manufacturer.

1.7 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 weather, condensation, direct sunlight, construction traffic, and potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 for gypsum board manufacturer's written instructions, whichever are more stringent.
   1. Do not install paper faced gypsum panels until installation areas are enclosed and conditioned.

B. Room Temperatures: Maintain minimum 40 degrees F (4 degrees C). For adhesive attachment and finishing of gypsum board, maintain minimum 50 degrees F (10 degrees C) for 48 hours before application and continuously after until dry. Do not exceed 95 degrees F (35 degrees C) when using temporary heat sources.

C. Ventilation: Ventilate building spaces as required to dry joint treatment materials. Avoid drafts during hot, dry weather to prevent finishing materials from drying too rapidly.

D. Do not install panels that are wet, moisture damaged, and mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

1.9 WARRANTY

A. Warrant the work specified for one (1) year against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials or workmanship.

B. In addition, provide warranty from the manufacturer for the following products:
   1. Exterior sheathing weathering warranty covering in-place exposure damage to exterior sheathing for twelve (12) months.
   2. Exterior sheathing warranty against manufacturing defects for five (5) years.
   3. Tile backer board warranty against manufacturing defects for Twenty (20) years.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Gypsum Board:
      a. Georgia Pacific.
      b. National Gypsum Company.
      c. USG Corporation.
      d. Comparable product.

   2. Tile Backer Board:
      a. Georgia Pacific, Dens-Shield Tile Baker
      b. USG, Durock Tile Backer.
      c. Comparable product.

   3. Water Resistant Gypsum Board:
      a. Gold Bond Hi-Abuse XP, by National Gypsum
      b. Gold Bond Hi-Impact, by National Gypsum
      c. Comparable product.

4. Cementitious Board:
   a. Custom Building Products
   b. National Gypsum Company
   c. United States Gypsum company

B. Gypsum Board: ASTM C 1396/C 1396M, applicable to type of gypsum board indicated and whichever is more stringent.
   1. Core: Use Type X throughout
      a. Thickness: 5/8 inch (15.9 mm).
      b. Long Edges: Tapered and featured (rounded or beveled) for prefilling.

   2. Ceiling Type: Manufactured for sag resistance
      a. Thickness: 1/2 inch (13mm).
      b. Long Edges: Tapered.

   3. Moisture and Mold Resistant Type: Type X with moisture and mold resistant core and surfaces. Core:
      a. Thickness: 5/8 inch (15.9 mm).
      b. Long Edges: Tapered.

C. Reinforced Gypsum Sheathing (Tile Backer Board): ASTM C 1278/C 1278M, standard edges. Cellulose fiber reinforced panels may be used in lieu of cementitious board.
   1. Core and Thickness: 1/2 inch (12.7 mm) or 5/8 inch (15.9 mm) to match conditions, Type X.
   2. Long Edge: Tapered.
   3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

D. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or ASTM C 1325.
   1. Thickness: ½ inch (12.7 mm)
   2. Long Edges: Standard.
   3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

E. Shaft Liner Boards: ASTM C 1396 and ASTM C 1658.
   1. Thickness: 1 inch.
   2. Width: 2 feet.
   3. Weight: 4.0 lb per sq. ft.
   4. Edges: Double Bevel
   5. R-Value: ASTM C 518 ,not less than 0.65.
   6. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
   7. Microbial Resistance: ASTM D 6329, will not support microbial growth.
   8. Basis of Design: Densglass Shaftliner by Georgia Pacific.

F. Exterior Gypsum Sheathing Board: Backside of Parapet Walls, behind stucco, under soffits; ASTM C1177; moisture resistant, and fire resistant, Type X, 1/2 inch thick, maximum permissible length, ends square cut, inorganic glass fiber mat faced, 48 inch width, DensGlass Exterior Sheathing by Georgia Pacific, USG Securock Glass-Mat, Gold Bond Brand e²XP Extended Exposure Sheathing by NationalGypsum, GlasRoc Brand Sheathing by BPB America or equal. Install Weather Resistive Barrier at exterior wall over sheathing substrate:
   1. Weather barrier as specified and detailed.

G. Exterior Trim: ASTM C 1047, hot dip galvanized steel sheet, plastic, or rolled zinc.
   1. Shapes:
      a. Cornerbead.
      b. LC Bead: J shaped; exposed long flange receives joint compound.
      c. Expansion (Control) Joint: One piece, rolled zinc with V shaped slot and removable strip covering slot opening.

H. Interior Trim: ASTM C 1047; galvanized or aluminum coated steel sheet, rolled zinc, plastic, or paper faced galvanized steel sheet.
   1. Shapes:
      a. Cornerbead.
      b. Bullnose bead.
      c. LC Bead: J shaped; exposed long flange receives joint compound.
      d. L Bead: L shaped; exposed long flange receives joint compound.
      e. U Bead: J shaped; exposed short flange does not receive joint compound.
      f. Expansion (control) joint.

   2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Fry Reglet Corp.
      b. Gordon, Inc.
      c. Pittcon Industries.

I. Continuous Corner: Extruded Aluminum; continuous integral fin for surface contact with gypsum board; 7/8 inch (22 mm) wide, tapered to edge; punched with holes staggered to accept screw fastening. Prime with corrosion resistant primer. Provide Pittcon Softforms SO-HSE-90 or Schluter.
   1. Basis of Design: Pittcon Softforms SO-HSE-90; Subject to compliance with requirements, provide basis of design or comparable by one of the following:
      a. Fry Reglet Corporation.
      b. Pittcon Industries.
      c. Schluter.

J. Joint Treatment: ASTM C 475/C 475M.
   1. Joint Tape:
      a. Exterior Gypsum Soffit Board: Paper.
      b. Joint Compound for Exterior Applications, Glass Mat Gypsum Sheathing Board: Recommended by sheathing board manufacturer.
      c. Joint Tape, Interior Gypsum Board: Paper.

   2. Joint Compound:
      a. Gypsum Board: Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting type taping compound.
         1) Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting type taping compound.
            a) Use setting type compound for installing paper faced metal trim accessories.
         2) Fill Coat: For second coat, use setting type, sandable topping compound.
         3) Finish Coat: For third coat, use setting type, sandable topping compound.
         4) Skim Coat: For final coat of Level 5 finish, use setting type, sandable topping compound.
      b. Cementitious Units: Recommended by backer unit manufacturer.
      c. Tile Backing Panels: Recommended by backer unit manufacturer.
      d. Water Resistant Gypsum Backing Board: Use setting type taping compound and setting-type, sandable topping compound.

K. Auxiliary Gypsum Materials: Comply with referenced installation standards and manufacturer's written recommendations.
   1. Steel Drill Screws: ASTM C 1002, use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
   2. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

a. Fire Resistance Rated Assemblies: Comply with mineral-fiber requirements of assembly.

3. Acoustical Sealant: Nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Hilti, Inc.
      2) Pecora Corporation.
      3) Specified Technologies, Inc.
      4) United States Gypsum Company.

4. Reveal Moldings: Extruded aluminum moldings, reveals, control joints. 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/finish as selected by Architect.
   a. Manufacturers: Subject to compliance with requirements, provide products by the following:
      1) Fry Reglet Corp.
      2) Gordon, Inc.
      3) MM Systems Corporation.
      4) Pittcon Industries.
      5) Or equal.
   b. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, alloy 6063-T5.
   c. Finish: Anodized finish, Class II medium etch 0.40 mils, AA-M12C22A31, color per Architect.
   d. Refer to drawings for types and sizes.

5. Access Doors: Refer to Section 08 31 13 for Access Doors to be provided at gypsum board walls and/or ceilings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow metal frames, cast in anchors, and structural framing, for compliance with requirements and other conditions affecting performance. Proceed with installation after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Installation Standard: ASTM C 754, except comply with framing sizes and spacing indicated.

B. Gypsum Board Assemblies: Comply with requirements in ASTM C 840 applicable to framing installation.

C. Install gypsum board in accordance with ASTM C840, GA 201, GA 216 and Section 2508 California Building Code. Conform to DSA, IR 25-3.

D. Sound Insulation: Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.

E. Gypsum Panels: Comply with ASTM C 840. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
   1. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
   2. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.
   3. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
   4. Form control and expansion joints with space between edges of adjoining gypsum panels.
   5. Cover both faces of support framing with gypsum panels in concealed spaces, except in chases braced internally.
      a. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
      b. Fit gypsum panels around ducts, pipes, and conduits.
      c. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4 inch to 3/8 inch (6.4 mm to 9.5 mm) wide joints to install sealant.
   6. Isolate perimeter of gypsum board applied to nonload bearing partitions at structural abutments, except floors. Provide 1/4 inch to 1/2 inch (6.4mm to 12.7mm) wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
   7. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

F. Gypsum Board: Install interior gypsum board where indicated on drawings.
   1. Single Layer Application:
      a. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
      b. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated or required by fire resistance rated assembly, and minimize end joints. Stagger abutting end joints not less than one framing member in alternate courses of panels.
      c. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

   2. Multilayer Application:
      a. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
      b. On Z shaped furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
      c. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

G. Backing Panels:
   1. Cementitious Backer Units: ANSI A108.11; install where indicated with 1/4 inch (6.4 mm) gap where panels abut other construction or penetrations. Where tile backing panels abut

other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

H. Exterior Gypsum Board Soffits: Apply panels perpendicular to supports, with end joints staggered and located over supports.
1. Install with 1/4 inch (6.4 mm) open space where panels abut other construction or structural penetrations.
2. Fasten with corrosion-resistant screws.

I. Trim Accessories: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Attach trim according to manufacturer's written instructions.
1. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.
2. Exterior Trim: Install in the following locations:
   a. Cornerbead: Use at outside corners.
   b. LC Bead: Use at exposed panel edges.
3. Interior Trim: Install in the following locations:
   a. Cornerbead: Use at outside corners, unless otherwise indicated.
   b. Bullnose Bead: Use at outside corners.
   c. LC Bead: Use at exposed panel edges.
   d. L Bead: Use where indicated or necessary.
   e. U Bead: Use at exposed panel edges.

J. Gypsum Board Finishing: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
1. Prefill open joints, rounded or beveled edges, and damaged surface areas.
2. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
3. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
   a. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
   b. Level 2: Panels that are substrate for tile.
   c. Level 3: Surfaces be coated with orange peel finish.
   d. Level 4: For surfaces receiving wall covering and flat paints.
   e. Level 5: For surfaces receiving gloss or semigloss paint and surfaces subjected to severe lighting.

3.3 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.
1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 21 16

SECTION 09 24 00

CEMENT PLASTERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes: Requirements including but not limited to:
   1. Exterior plasterwork (stucco).
   2. Metal lath and furring.
   3. Accessories necessary for a complete installation.

1.3 RELATED SECTIONS

A. Section 05 40 00: Cold-Formed Metal Framing

B. Section 07 92 00: Joint Sealants.

C. Section 09 90 00: Painting and Coatings.

1.4 SUBMITTALS

A. Product Data: Submit technical data for product and accessory, including construction details and material descriptions.

B. Shop Drawings: Show locations and installation of control and expansion joints, including plans, elevations, sections, details of components, and attachments to other work.

C. Samples: Two (2) square sample for each texture to be used.

D. Warranty: Sample of manufacturer’s warranty.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Building Code: Comply with applicable provisions of the CBC 2022 California Building Code (CCR Title 24, Part 2, as adopted and amended by DSA). And DSA IR 25-4 for self-furring lath.
   2. Fire Resistance Ratings: Where indicated, provide cement plaster assemblies identical to those of assemblies tested for fire resistance according to ASTM E 119 by a qualified testing agency.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver cementitious materials in original packages, containers, or bundles, labeled with manufacturer's name, product brand name, and lot number.

B. Store materials inside under cover, and keep them dry and protected against damage from weather, moisture, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

1.7 PROJECT CONDITIONS

A. Comply with applicable requirements of ASTM C 926.

B. Environmental Requirements: Comply with requirements of referenced plaster application standards and recommendations of plaster manufacturer for environmental conditions before, during, and after plaster application.

C. Cold Weather Requirements: Provide heat and protection, temporary or permanent, as required to protect each coat of plaster from freezing for at least 24 hours after application. Distribute heat uniformly to prevent concentration of heat on plaster near heat sources; provide deflection or protective screens.

D. Warm Weather Requirements: Protect plaster against uneven and excessive evaporation and from strong flows of dry air, both natural and artificial. Apply and cure plaster as required by climatic and job conditions to prevent dry out during cure period. Provide suitable coverings, moist curing, barriers to deflect sunlight and wind, or combinations of these, as required.

E. Ventilation: Provide natural or mechanical means of ventilation to properly dry interior spaces after portland cement plaster has cured.

F. Exterior Plasterwork:
1. Apply and cure plaster to prevent plaster drying out during curing period. Use procedures required by climatic conditions, including moist curing, providing coverings, and providing barriers to deflect sunlight and wind.
2. Apply plaster when ambient temperature is greater than 40 degrees F (4.4 degrees C).
3. Protect plaster coats from freezing for not less than 48 hours after set of plaster coat has occurred.

G. Protect contiguous work from soiling and moisture deterioration caused by plastering. Provide temporary covering and take precautions necessary to minimize spattering of plaster on adjacent work.

H. Factory Prepared Finishes: Comply with manufacturer's written recommendations for environmental conditions for applying finishes.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Manufacturers: Subject to compliance with requirements, provide products of one of the following:
1. Metal Lath and Accessories:
   a. Alabama Metal Industries (AMICO).
   b. CEMCO.
   c. ClarkDietrich Building Systems.
   d. Marino/WARE.
   e. Phillips Manufacturing.

2. Plastic Accessories:
   a. Alabama Metal Industries (AMICO).

b. Phillips manufacturing.
c. Plastic Components.
d. Vinyl Corp.

3. Ready Mixed Finish Coat Plaster:
   a. California Stucco Product.
   b. El Rey Solutions.
   c. Omega Products International.
   d. Quikrete.
   e. Shamrock Stucco.

4. Acrylic Based Finish Coat:
   a. California Stucco Product.
   b. Dryvit Systems.
   c. El Rey Solutions.
   d. Finestone, BASF Corp.
   e. LaHabra, a brand of Parex USA, Inc.
   f. Omega Products International.
   g. Senergy, BASF Corp.
   h. Sto Corp.

B. Barrier:
   1. Two (2) layers of Type D, 30 pound organic felts, stagger seams.

C. Metal Lath:
   1. Expanded Metal Lath: ASTM C 847, cold rolled carbon steel sheet with ASTM A 653/A 653M, G60 (Z180), hot dip galvanized zinc coating.
      a. Diamond Mesh Lath: Self furring, 3.4 lb/sq. ft.
      b. Comply with DSA IR 25-4 for the installation of Self-Furring Metal Lath.

D. Accessories: Comply with ASTM C 1063, and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.
   1. Metal Accessories:
      a. Foundation Weep Screed: Fabricated from hot dip galvanized steel sheet, ASTM A 653/A 653M, G60 (Z180) zinc coating.
      b. Cornerite: Fabricated from metal lath with ASTM A 653/A 653M, G60 (Z180), hot dip galvanized-zinc coating.
      c. Outside Corner Reinforcement: Fabricated from metal lath with ASTM A 653/A 653M, G60 (Z180), hot dip galvanized zinc coating.
      d. Cornerbeads: Fabricated from zinc or zinc coated (galvanized) steel.
         1) Smallnose cornerbead with expanded flanges; use unless otherwise indicated.
         2) Smallnose cornerbead with expanded flanges reinforced by perforated stiffening rib; use on columns and for finishing unit masonry corners.

      e. Casing Beads: Fabricated from zinc or zinc coated (galvanized) steel; square edged style; with expanded flanges.
      f. Control Joints: Fabricated from zinc or zinc coated (galvanized) steel; one piece type, folded pair of unperforated screeds in M shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.

E. Miscellaneous Materials:
   1. Water for Mixing and Finishing Plaster: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.
   2. Fiber for Base Coat: Alkaline resistant glass or polypropylene fibers, 1/2 inch (13 mm) long, free of contaminants, manufactured for use in cement plaster.

3. Bonding Compound: ASTM C 932.
4. Fasteners for Attaching Metal Lath to Substrates: ASTM C 1063.
5. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
    a. Fire Resistance Rated Assemblies: Comply with mineral-fiber requirements of assembly.

F. Plaster Materials:
1. Portland Cement: ASTM C 150/C 150M, Type I.
    a. Color for Finish Coats: Integral color plaster shall match exterior paint color as indicated, provide sample/mock-up for approval by Architect.

2. Colorants for Job Mixed Finish Coats: Colorfast mineral pigments that produce finish plaster color selected by Architect.
3. Lime: ASTM C 206, Type S; or ASTM C 207, Type S.
4. Sand Aggregate: ASTM C 897.
    a. Color for Job Mixed Finish Coats: White**.**

5. Exposed Aggregates for Finish Coats: Match existing with integral color plaster.
6. Ready Mixed Finish Coat Plaster: Mill mixed portland cement, aggregates, coloring agents, and proprietary ingredients.
    a. Color: Integral color plaster shall match exterior paint color as indicated, provide sample/mock-up for approval by Architect.

7. Acrylic Based Finish Coatings: Factory mixed acrylic emulsion coating systems formulated with colorfast mineral pigments and fine aggregates; for use over cement plaster base coats. Include manufacturer's recommended primers and sealing topcoats for acrylic based finishes.
    a. Color: Integral color plaster shall match exterior paint color as indicated, provide sample/mock-up for approval by Architect.

2.2 PLASTER MIXES

A. Comply with ASTM C 926 for applications indicated.
1. Fiber Content: Add fiber to base coat mixes after ingredients have mixed at least two minutes. Comply with fiber manufacturer's written instructions for fiber quantities in mixes, but do not exceed 1 lb of fiber/cu. yd. (0.6 kg of fiber/cu. m) of cementitious materials.

B. Base Coat Mixes for Use over Metal Lath: Scratch and brown coats for three coat plasterwork:
1. Portland Cement Mix:
    a. Scratch Coat: For cementitious material, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
    b. Brown Coat: For cementitious material, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 3 to 5 parts aggregate per part of cementitious material, but not less than volume of aggregate used in scratch coat.

C. Job Mixed Finish Coat Mixes:
1. Portland Cement Mix: For cementitious materials, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 1-1/2 to 3 parts aggregate per part of cementitious material.

D. Factory Prepared Finish Coat Mixes: For ready mixed finish coat plasters or acrylic based finish coatings, comply with manufacturer's written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the work. Proceed with installation after correcting unsatisfactory conditions.

3.2 PREPARATION

A. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.

B. Prepare smooth, solid substrates for plaster according to ASTM C 926.

3.3 INSTALLATION

A. Metal Lath: Install according to ASTM C 1063.
   1. Partition Framing and Vertical Furring: Flat diamond mesh lath.
   2. Horizontal Framing: Flat diamond mesh lath.

B. Accessories: Install according to ASTM C 1063 and at locations indicated on Drawings.
   1. Reinforcement for External (Outside) Corners:
      a. Install cornerbead at exterior locations.
      b. Install cornerbead at interior locations.

   2. Control Joints: Locate as approved by Architect for visual effect where not illustrated on drawings.
      a. As required to delineate plasterwork into areas (panels) of the following maximum sizes:
         1) Vertical Surfaces: 144 sq. ft. (13.4 sq. m).
         2) Horizontal and Other Nonvertical Surfaces: 100 sq. ft. (9.3 sq. m).
      b. At distances between control joints of not greater than 18 feet (5.5 m) o.c.
      c. As required to delineate plasterwork into areas (panels) with length-to-width ratios of not greater than 2-1/2:1.
      d. Where control joints occur in surface of construction directly behind plaster.
      e. Where plasterwork areas change dimensions, to delineate rectangular shaped areas (panels) and to relieve the stress that occurs at the corner formed by the dimension change.

3.4 PLASTER APPLICATION

A. Comply with ASTM C 926.
   1. Do not deviate more than plus or minus 1/4 inch in 10 feet (6 mm in 3 m) from a true plane in finished plaster surfaces when measured by a 10-foot (3-m) straightedge placed on surface.
   2. Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.
   3. Provide plaster surfaces ready to receive field applied finishes indicated.
   4. Provide a gap for deflection where stucco walls terminate either at floor and/or roof deck.

B. Flat Surface Tolerances: Do not deviate more than plus or minus 1/8 inch in 10 feet (3 mm in 3 m) from a true plane in finished plaster surfaces, measured by a 10 foot (3m) straightedge placed at any location on surface.

C. Walls; Base Coat Mixes for Use over Metal Lath: For scratch and brown coats, for three coat plasterwork with 7/8 inch (22 mm) total thickness:
1. Portland cement mixes.

D. Plaster Finish Coats: Apply to provide dash finish.

E. Acrylic Based Finish Coatings (Contractor Option to Plaster Finish Coat): Apply coating system, including primers, finish coats, and sealing topcoats, according to manufacturer's written instructions.

F. Concealed Exterior Plasterwork: Where plaster application is used as a base for adhered finishes, omit finish coat.

3.5 PLASTER REPAIRS

A. Repair or replace work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

B. Cut, patch, replace, repair, and point up plaster as necessary to accommodate other work. Repair cracks and indented surfaces. Point up finish plaster surfaces around items that are built into or penetrate plaster surfaces. Repair or replace work to eliminate blisters, buckles, check cracking, dry outs, efflorescence, excessive pinholes, and similar defects. Repair or replace work as necessary to comply with required visual effects.

3.1 TOLERANCES

A. Maximum Variation from True Lines and Levels: 1/8 inch in 10 feet (3mm in 3 m).

B. Maximum Variation from True Position: 1/8 inch (3mm).

3.2 CLEANING AND PROTECTION

A. Remove temporary protection and enclosure of work after plastering is complete. Promptly remove plaster from door frames, windows, and other surfaces not indicated to be plastered. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.

B. Remove unused materials, containers, equipment, and plaster debris.

C. Protect plaster and maintain conditions ensuring finished plaster is without damage or deterioration at time of Substantial Completion.

END OF SECTION 09 24 00

SECTION 09 30 00

TILE

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes: Requirements including but not limited to:
   1. Ceramic mosaic tile.
   2. Porcelain tile.
   3. Accessories required for indicated installation.

1.3 RELATED SECTIONS

A. Section 03 30 00: Cast-In-Place Concrete.

B. Section 09 21 16: Gypsum Board Assemblies.

1.4 REFERENCE STANDARDS

A. American National Standards Institute (ANSI).

B. Tile Council of North America (TCNA).
   1. Reference TCNA method numbers for tile assemblies.

C. Comply with Health Department requirements for tile in food service facilities

D. Quarry Tile Flooring shall be stable, firm and slip resistant. CBC Section 11B-302.1

1.5 PERFORMANCE REQUIREMENTS

A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with values determined by testing identical products per ASTM C 1028:
   1. Level Surfaces: Minimum 0.6.
   2. Ramp Surfaces: Minimum 0.8.

1.6 SUBMITTALS

A. Product Data: Technical data including data sheets, installation recommendation, and recommended joint widths.

B. Shop Drawings: Show locations of each type of tile and tile pattern.
   1. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Samples: Submit samples showing full range of color and texture variations expected.
   1. Full size units of each type and composition of tile and for each color and finish required.

2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required; minimum 12 inches (300 mm) square, but not fewer than four tiles. Use grout of type and in color or colors approved for completed work.
3. Waterproof membrane in 6 x 6-inch sample.
4. Thresholds in 6 inch (150 mm) lengths.

D. Test Reports: Submit test reports from qualified independent testing laboratory indicating and interpreting test results relative to compliance of tile products with requirements for slip resistance.

E. Maintenance Instructions: Submit maintenance instructions for each type of product specified.

1.7 QUALITY ASSURANCE

A. Regulatory Requirements:
1. Building Code: Comply with applicable requirements for the IBC for interior finishes.
2. Surface Burning Characteristics: ASTM E 84; identify products with appropriate markings of applicable testing agency.
   a. Flame Spread Index: 25 or less.
   b. Smoke Developed Index: 450 or less.
3. Accessibility Requirements: Comply with applicable requirements.
   a. Americans with Disabilities Act of 1990, as amended.
      1) ADA Title II Regulations & the 2010 ADA Standards for Accessible Design
   b. CBC 2022 California Building Code (CCR Title 24, Part 2, as adopted and amended by DSA).
      2) CBC Chapter 11B, Access to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing.

B. Source Limitations for Tile: Obtain tile of same type and color or finish from one source or producer. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.

C. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.

D. Source Limitations for Other Products: Obtain each of the following products specified in this Section through one source from a single manufacturer for each product:
1. Stone thresholds.
2. Waterproofing.
3. Joint sealants.
4. Metal edge strips.

E. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Build mockup of each type of floor tile installation.
2. Build mockup of each type of wall tile installation.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels

intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided. Store liquid materials in unopened containers and protected from freezing.

C. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

B. Contractor is required to achieve the specified concrete moisture content prior to installation of all flooring materials or use a flooring manufacture approved moisture barrier prior to installation of all flooring products.

C. Maintain temperatures at 50 degrees F or more in tiled areas during installation and for 7 days after completion, unless higher temperatures are required by referenced installation standard or manufacturer's instructions.

1.10 EXTRA MATERIALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Tile and Trim Units: Furnish quantity of full size units equal to 2 percent of field tile and 5 percent of amount installed trims, accent tiles, and shapes, composition, color, pattern, and size indicated.
   2. Grout: Furnish quantity of grout equal to 2 percent of amount installed for each type, composition, and color indicated.

1.11 WARRANTY

A. Warrant the work specified, including backer boards but not limited to, for one (1) year against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials or workmanship.

PART 2 PRODUCTS

2.1 MATERIALS

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated. Provide tile complying with Standard grade requirements.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and

package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

D. Mounting: For factory mounted tile, provide back or edge mounted tile assemblies as standard with manufacturer unless otherwise indicated.
   1. Where tile is indicated for installation on exteriors or in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

2.2 TILE PRODUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Ceramic Tile:
      a. Crossville, Inc.
      b. Daltile.
      c. Or approved equal.
   2. Porcelain Tile:
      a. American Olean
      b. Crossville, Inc.
      c. Daltile.
      d. Or approved equal.

B. Porcelain Floor Tile: Unglazed tile with through color.
   1. Basis of Design Product/Manufacturer: Daltile
   2. Finish: Unpolished and light polished finish (50% unpolished / 50% light polished)
   3. Module Size: 2 inches, square.
   4. Thickness: 1/2 inch (12.7 mm).
   5. Colors: As selected by Architect from manufacturer's full range of available colors. Refer to Finish Schedule.
   6. Tile Trims and Shapes: Select tile that has the required trim in matching colors.
   7. Borders and Patterns: Moderate complexity patterns as noted on drawings and confirmed by Architect**.** Allow for angles and cutting of tiles.
   8. Grout Color: Selected by Architect unless noted otherwise.

C. Ceramic Floor Tile: Factory mounted unglazed ceramic mosaic tile.
   1. Basis of Design Product/Manufacturer: Daltile
   2. Type: Refer to finish schedule.
   3. Module Size: 2 inches, square.
   4. Thickness: 1/4 inch (6.4 mm).
   5. Face: Plain with cushion edges.
   6. Surface: Smooth, without or slip resistant, with abrasive admixture.
   7. Tile Color and Pattern: Refer to Drawings.
   8. Grout Color: Selected by Architect unless noted otherwise.

D. Ceramic Wall Tile: Glazed tile.
   1. Basis of Design Product/Manufacturer: Dal-Tile
   2. Composition: Impervious natural clay tile.
   3. Module Size: 4 1/4 inches, square.
   4. Thickness: 5/16 inch (8 mm).
   5. Face: Plain with cushion edges.
   6. Surface: Matte glazed.
   7. Base: Six (6) inch high x Six (6) inch wide ceramic tile cove base to match wall tile.
   8. Tile Color and Pattern: Refer to Drawings.
   9. Grout Color: Selected by Architect unless noted otherwise.

10. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable matching characteristics of adjoining flat tile. Provide shapes selected from standard shapes:
    a. Wainscot Cap for Thinset Mortar Installations: Surface bullnose, module size 1 inch by 1 inch (25.4 mm by 25.4 mm) or 2 inch by 1 inch (50.8 mm by 25.4 mm) or 2 inch by 2 inches (50.8 mm by 50.8 mm).
    b. Wainscot Cap for Flush Conditions: Regular flat tile for conditions where tile wainscot is shown flush with wall surface above it, same size as adjoining flat tile.
    c. External Corners for Thinset Mortar Installations: Surface bullnose, module size 1 inch by 1 inch (25.4 mm by 25.4 mm) or 2 inch by 1 inch (50.8 mm by 25.4 mm) or 2 inch by 2 inches (50.8 mm by 50.8 mm).
    d. Internal Corners: Cove, module size 1 inch by 1 inch (25.4 mm by 25.4 mm) or 2 inches by 1 inch (50.8 mm by 25.4 mm).
    e. Internal Corners: Field-butted square corners. For coved base and cap, use angle pieces designed to fit with stretcher shapes.
    f. Tapered Transition Tile: Shape designed to effect transition between thickness of tile floor and adjoining floor finishes of different thickness, tapered to provide reduction in thickness from 1/2 to 1/4 inch (12.7 to 6.4 mm) across nominal 4 inch (100 mm) dimension.

E. Threshold: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
    1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/4 inch (6.35 mm) above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch (12.7 mm) or less above adjacent floor surface.
    2. Granite Thresholds: ASTM C 615/C 615M, with honed finish.
        a. Description: Uniform, medium grained, white stone without veining.

2.3 WATERPROOF MEMBRANE

A. Waterproof membrane complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Fluid Applied Membrane: Liquid latex rubber or elastomeric polymer.
    1. Basis of Design: Laticrete 9235 Waterproofing Membrane. Subject to compliance with requirements, provide basis if design or comparable product by one of the following:
        a. Laticrete International, Inc.
        b. MAPEI Corporation.
        c. TEC; H.B. Fuller Construction Products Inc.

C. Fabric Reinforced, Fluid Applied Membrane: System consisting of liquid latex rubber or elastomeric polymer and continuous fabric reinforcement.
    1. Basis of Design: Laticrete 9235 Waterproofing Membrane and reinforcing Fabric. Subject to compliance with requirements, provide basis if design or comparable product by one of the following:
        a. Laticrete International, Inc.
        b. MAPEI Corporation.
        c. Merkrete by Parex USA, Inc.

D. Latex Portland Cement Waterproof Mortar: Flexible, waterproof mortar consisting of cement based mix and latex additive.
    1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
        a. C-Cure.
        b. MAPEI Corporation.

c. TEC; H.B. Fuller Construction Products Inc.

E. Liquid Latex Waterproofing/Crack Isolation Membrane: Single Component, self-curing, load bearing liquid rubber polymer that forms a flexible seamless combined waterproofing membrane and crack isolation membrane compliance with ANSI A118.10 and ANSI 118.12.
1. Basis of Design: Hydroban by Laticrete International. Subject to compliance with requirements, provide basis of design or comparable product by one of the following:
a. Laticrete International, Inc.
b. MAPEI Corporation.
c. TEC; H.B. Fuller Construction Products Inc.

2.4 CRACK ISOLATION MEMBRANE

A. Crack isolation membrane complying with ANSI A118.12 for standard performance and recommended by manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Fabric Reinforced, Modified Bituminous Sheet: Self adhering, modified bituminous sheet with fabric reinforcement facing; 0.040 inch (1 mm) nominal thickness.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Custom Building Products.
b. MAPEI Corporation.

C. Fluid Applied Membrane: Liquid latex rubber or elastomeric polymer.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Custom Building Products.
b. Laticrete International, Inc.
c. MAPEI Corporation.
d. Merkrete by Parex USA, Inc.
e. TEC; H.B. Fuller Construction Products Inc.

D. Fabric Reinforced, Fluid Applied Membrane: System consisting of liquid latex rubber or elastomeric polymer and fabric reinforcement.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Bonsal American, an Oldcastle company.
b. Bostik, Inc.
c. Custom Building Products.
d. Laticrete International, Inc.
e. MAPEI Corporation.
f. Merkrete by Parex USA, Inc.

2.5 SETTING MATERIALS

A. Dry Set Mortar (Thinset): ANSI A108.1B.
1. Mortar Bed: Proportions of 1 part Portland Cement to 5 parts sand.
a. Portland Cement: ASTM C150, Type 1.
b. Sand: ASTM C144.
c. Water: Potable.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Custom Building Products.
b. Laticrete International, Inc.

c. MAPEI Corporation.

3. Wall Applications: Provide mortar complying with requirements for non-sagging mortar in addition to requirements in ANSI A108.1 and ANSI 108.2.

B. Modified Dry Set Mortar (Thinset): ANSI A118.4.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Laticrete International, Inc.
b. MAPEI Corporation.
c. TEC; H.B. Fuller Construction Products Inc.
2. Provide prepackaged, dry mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid latex additive at site.
3. Wall Applications: Provide mortar complying with requirements for non-sagging mortar in addition to requirements in ANSI A118.4.

C. Improved Modified Dry Set Mortar (Thinset): ANSI A118.15.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Laticrete International, Inc.
b. MAPEI Corporation.
c. TEC; H.B. Fuller Construction Products Inc.

2. Provide prepackaged, dry mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid latex additive at Project site.
3. For wall applications, provide mortar complying with requirements for non-sagging mortar in addition to the other requirements in ANSI A118.15.

D. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.1A.
1. Mortar Bed: Proportions of 1 part Portland Cement to 5 parts sand.
a. Portland Cement: ASTM C150, Type 1.
b. Sand: ASTM C144.
c. Water: Potable.
2. Cleavage Membrane: Asphalt felt, ASTM D 226/D 226M, Type I (No. 15); or polyethylene sheeting, ASTM D 4397, 4.0 mils (0.1 mm) thick.
3. Reinforcing Wire Fabric: Galvanized, welded-wire fabric, 2 by 2 inches (50.8 by 50.8 mm) by 0.062 inch (1.57 mm) diameter; comply with ASTM A 185/A 185M and ASTM A 82/A 82M, except for minimum wire size.
4. Expanded Metal Lath: Diamond mesh lath complying with ASTM C 847.
a. Base Metal and Finish for Interior Applications: Uncoated or zinc-coated (galvanized) steel sheet, with uncoated steel sheet painted after fabrication into lath.
b. Base Metal and Finish for Exterior Applications: Zinc coated (galvanized) steel sheet.
c. Configuration over Studs and Furring: Flat.
d. Configuration over Solid Surfaces: Self furring.
e. Weight: 3.4 lb/sq. yd. (1.8 kg/sq. m).
5. Latex Additive: Styrene-butadiene-rubber water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex additive manufacturer for use with field mixed Portland cement and aggregate mortar bed.

E. Tile Setting Epoxy: ANSI A118.3, water cleanable; 100 percent solids epoxy grout.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Polyblend Tile Grout with 100% Solids Epoxy; Custom Building Products.
b. SpectraLOCK PRO Stainless Grout; Laticrete International, Inc.

2. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 degrees F and 212 degrees F (60 degrees C and 100 degrees C), respectively, and certified by manufacturer for intended use.
3. Color: Selected by Architect.

2.6 GROUT MATERIALS

A. Water Cleanable Epoxy Grout: ANSI A118.3.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Polyblend Tile Grout with 100% Solids Epoxy; Custom Building Products.
   b. SpectraLOCK PRO Stainless Grout; Laticrete International, Inc.
   c. MAPEI Corp., Kerapoxy or Kerapoxy CQ Epoxy Grout.
2. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 degrees F and 212 degrees F (60 degrees and 100 degrees C), respectively, and certified by manufacturer for intended use.

2.7 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex modified, Portland cement-based formulation provided or approved by manufacturer of tile setting materials for installations indicated.

B. Vapor Retarder Membrane: Polyethylene sheeting, ASTM D 4397, 4.0 mils (0.1 mm) thick.

C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

D. Tile and Grout Sealer: Sealer for sealing grout joints and that does not change color or appearance of grout.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Custom Building Products.
   b. Summitville Tiles, Inc.
   c. TEC; H.B. Fuller Construction Products Inc.

E. Sealant: Silicone sealant; refer to Section 07 92 00.
1. Top of Wainscot: Bullnose

2.8 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed for compliance with requirements for installation tolerances and other conditions affecting performance of the work.
   1. Verify substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
   2. Verify concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
      a. Verify surfaces that received a steel trowel finish have been mechanically scarified.
      b. Verify protrusions, bumps, and ridges have been removed by sanding or grinding.
   3. Verify installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
   4. Verify joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation after correcting unsatisfactory conditions.

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with adhesives or thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.

C. Blending: For tile exhibiting color variations, verify tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at site before installing.

3.3 INSTALLATION

A. Comply with TCNA *Handbook for Ceramic, Glass, and Stone Tile Installation* for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series *Specifications for Installation of Ceramic Tile* that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
   1. For the following installations, comply with ANSI A108 series procedures for tile installation standards for providing 95 percent mortar coverage:
      a. Exterior tile floors.
      b. Tile floors in wet areas.
      c. Tile floors consisting of tiles 8 by 8 inches (200 by 200 mm) or larger.
      d. Tile floors consisting of rib-backed tiles.

B. Grout:
   1. Floor: 100 percent solid epoxy grout.
   2. Walls: Non-sanded grout.
   3. Grout to be sealed 28 days after installation.

C. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

E. Provide trim shapes where necessary to eliminate exposed tile edges.

F. Where accent tile differs in thickness from field tile, vary setting bed thickness so tiles are flush.

G. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
   1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
   2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
   3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

H. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
   1. Ceramic Mosaic Tile: 1/8 inch (3.2 mm).
   2. Porcelain Tile: 1/4 inch (6.4 mm)

I. Lay out tile wainscots to dimensions indicated.

J. Expansion Joints: Provide expansion joints and sealant filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw cut joints after installing tiles.
   1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.

K. Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.
   1. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor finishes, set thresholds in improved modified dry set mortar (thinset).
   2. Do not extend cleavage membrane waterproofing or crack isolation membrane under thresholds set in standard dry set, modified dry set or improved modified dry set mortar. Fill joints between such thresholds and adjoining tile set on cleavage membrane, waterproofing, or crack isolation membrane with elastomeric sealant.

L. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile and no threshold is indicated.

M. Floor Sealer: Apply floor sealer to cementitious grout joints in tile floors according to floor sealer manufacturer's written instructions. As soon as floor sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

N. Waterproofing: Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.
   1. Allow waterproofing to cure and verify by testing that it is watertight before installing tile or setting materials over it.

O. Crack Isolation Membrane: Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.
   1. Allow crack isolation membrane to cure before installing tile or setting materials over it.

P. Floor Tile: Install tile to comply with requirements in the TCNA installation methods and ANSI A108 series of tile installation standards.
   1. Back Buttering: For installations indicated, obtain 100 percent mortar coverage by complying with applicable special requirements for back buttering of tile in referenced ANSI A108 series of tile installation standards:
      a. Tile floors in wet areas, including showers.
      b. Tile floors composed of rib backed tiles.
   2. Tile Installation Method:
      a. Interior Floor Installations, Concrete Subfloor:
         1) TCNA F121 and ANSI A108.1A; cement mortar bed (thickset) on waterproof membrane.
         2) TCNA F122; thinset mortar on waterproof membrane.
      b. Interior Floor Installations, Wood Subfloor:
         1) TCNA F144; thinset mortar on waterproof membrane on cementitious backer.

Q. Wall Tile Installation: Install types of tile designated for wall installations to comply with requirements, including those referencing TCNA installation methods and ANSI setting bed standards.
   1. Back Buttering: For installations indicated, obtain 100 percent mortar coverage by complying with applicable special requirements for back buttering of tile in referenced ANSI A108 series of tile installation standards:
      a. Tile wall installations in wet areas, including showers.
      b. Tile installed with chemical resistant mortars and grouts.

3.4 ADJUSTING AND CLEANING

A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.

B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
   1. Remove grout residue from tile as soon as possible.
   2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.5 PROTECTION

A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

END OF SECTION 09 30 00

SECTION 09 51 00 ACOUSTICAL CEILING PANELS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements including but not limited to:
   1. Acoustical panels.
   2. Concealed and exposed suspension systems for ceilings.
   3. Ceiling panel for food service area.
   4. Accessories necessary for a complete installation.

1.3 SUBMITTALS

A. Product Data: Technical data for each product including installation instructions.

B. Samples:
   1. Acoustic Panel: Set of 6-inch (150 mm) square samples of each type, color, pattern, and texture.
   2. Exposed Suspension System Members, Moldings, and Trim: Set of 12-inch (300 mm) long samples of each type, finish, and color.

C. Coordination Drawings:
   1. Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
      a. Suspended ceiling components.
      b. Structural members to which suspension systems will be attached.
      c. Size and location of initial access modules for acoustical panels.
      d. Items penetrating finished ceiling including but not limited to the following:
         1) Lighting fixtures.
         2) Air outlets and inlets.
         3) Speakers.
         4) Sprinklers.
         5) Access panels.
      e. Perimeter moldings.

D. Maintenance Data: Manufacturer data for finishes for inclusion in maintenance manuals.

E. Submit one copy of ICC-ES Reports.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Building Code:
      a. Comply with applicable requirements of the CBC for interior finishes:
         1) DSA Interpretation of Regulations – IR 25-2.13 Metal Suspension Systems for Lay-in Panel Ceilings.
         2) CBC - 2022 California Building Code.
         3) Chapter 19, 2022 California Building Code.

4) Chapter 23, 2022 California Building Code.
5) Acoustical Panel Standard: ASTM E1264 and designated by type, form, pattern, acoustical rating, and light reflectance:
a) Mounting Method for Measuring NRC: Plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface according to ASTM E795.

2. Surface Burning Characteristics:
b. Ceiling panels with surface burning characteristics complying with CBC and ASTM E1264 for Class A materials determined by testing identical products in accordance with ASTM E84:
1) Flame Spread Index: 25 or less.
2) Smoke Developed Index: 450 or less.

3. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE 7.
4. Fire Resistance Ratings: Comply with ASTM E119; testing by qualified testing agency. Identify products with appropriate markings of applicable testing agency. Indicate design designations from UL *Fire Resistance Directory* or from the listings of another qualified testing agency.

B. Source Limitations:
1. Acoustical Ceiling Panel: Obtain each type through one source from a single manufacturer.
2. Suspension System: Obtain each type through one source from a single manufacturer.

C. Comply with applicable regulations regarding toxic and hazardous materials:
1. Coating Based Antimicrobial Treatment: Provide acoustical panels with face and back surfaces coated with antimicrobial treatment; and showing no mold or mildew growth when tested in accordance with ASTM D3273.
2. Panel Based Antimicrobial Treatment: Provide acoustical panels manufactured with antimicrobial treatment in the panels.

D. Pre-installation Conference: Conduct conference at site.

1.5 WARRANTY

A. Standard Ceiling Panels: Warrant ceiling panels to be free from sagging, warping, shrinking, buckling, or delaminating as a result of manufacturing defects for a period of one (1) year from the date of Substantial Completion.

B. Sag Resistant Ceiling Panels: warrant products to be free from sagging, warping, shrinking, buckling, or delaminating as a result of manufacturing defects for a period of ten (10) years from the date of Substantial Completion.

C. Standard Suspension System: Suspension systems shall be warranted to be free from defects in material or factory workmanship and shall not incur 50 percent red rust as defined by ASTM B117 test procedures for a period of ten (10) years from the date of Substantial Completion.

D. Suspension system / ceiling panels: Provide manufacturers standard 15 year warranty for suspension systems when used in combination with same manufacturers sag resistant ceiling panels. Ceiling panels to be free from sagging, warping, shrinking, buckling, or delaminating as a result of manufacturing defects. Suspension systems shall not incur 50 percent red rust as defined by ASTM B117 test during the period of the warranty, extra materials.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension system components, and accessories to site in original, unopened packages and store in a fully enclosed, conditioned space protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, allow panels to attain room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

PART 2 PRODUCTS

2.1 MATERIALS

A. Manufacturers are subject to compliance with requirements; provide ceiling panels and grid systems by one of the following:
   1. Concealed and Exposed Suspension Grid:
      c. Armstrong World Industries, Inc.
      d. CertainTeed Corporation.
      e. Chicago Metallic; Rockfon (Roxul Inc.).
      f. Hunter Douglas.
      g. USG Interiors.
   2. Acoustical Ceiling Panel:
      h. Armstrong World Industries, Inc.
      i. CertainTeed Corporation.
      j. Rockfon (Roxul Inc.).
      k. Tectum Inc.
      l. USG Interiors.
   3. Molding and Edge Trim:
      m. Armstrong World Industries, Inc.
      n. CertainTeed Corp.
      o. Chicago Metallic Corporation.
      p. Fry Reglet Corporation.
      q. Gordon, Inc.
      r. USG Interiors, Inc.; Subsidiary of USG Corporation.
   4. Acoustical Sealant for Exposed and Concealed Joints:
      s. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
      t. USG Corporation; SHEETROCK Acoustical Sealant.
   5. Acoustical Sealant for Concealed Joints:
      u. Henkel Corporation; OSI Pro-Series SC-175 Acoustical Sound Sealant.
      v. Pecora Corporation; AIS-919.

B. Acoustical Panel Colors and Patterns:
   1. Match appearance characteristics indicated for each product type:
      w. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E1264 and not manufacturers' proprietary product designations, provide products selected by Architect that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.2 METAL SUSPENSION SYSTEM

A. Metal Suspension System:

1. Direct hung metal suspension systems of types, structural classifications, and finishes indicated complying with applicable requirements in ASTM C635/C635M:
   x. High Humidity Finish:
      1) Comply with ASTM C635/C635M requirements for Coating Classification for Severe Environment Performance where high humidity finishes are indicated.
   y. Attachment Devices - Size for five times the design load indicated in ASTM C635/C635M, Table 1 Direct Hung, unless otherwise indicated. Comply with seismic design requirements:
      1) Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E488 or ASTM E1512 as applicable, conducted by a qualified testing and inspecting agency:
         a) Type: Cast in place, postinstalled expansion or postinstalled bonded anchors.
         b) Corrosion Protection: Carbon steel components zinc plated to comply with ASTM B633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.
         c) Corrosion Protection: Stainless steel components complying with ASTM F593 and ASTM F594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchor.
         d) Corrosion Protection: Components fabricated from nickel copper alloy rods complying with ASTM B164 for UNS No. N04400 alloy.
      2) Power Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion resistant materials, with clips or other accessory devices for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing according to ASTM E1190, conducted by a qualified testing and inspecting agency.
2. Wire Hangers, Braces, and Ties:
   z. Zinc Coated, Carbon Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
   aa. Stainless Steel Wire: ASTM A580/A580M, Type 304, nonmagnetic.
   bb. Nickel Copper Alloy Wire: ASTM B164, nickel copper alloy UNS No. N04400.
   cc. Size: Select wire diameter so its stress at three times hanger design load (ASTM C635/C635M, Table 1 Direct Hung) will be less than yield stress of wire, but provide not less than 0.106 inch (2.69 mm) diameter wire.
3. Hanger Rods and Flat Hangers: Mild steel, zinc coated or protected with rust inhibitive paint.
4. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed with 0.04 inch (1 mm) thick, galvanized steel sheet complying with ASTM A653/A653M, G90 (Z275) coating designation; with bolted connections and 5/16 inch (8 mm) diameter bolts.
5. Hold Down Clips: Provide hold down clips spaced 24 inches (610 mm) o.c. on all cross tees in areas with exterior opening larger than 48” x 96”.
6. Impact Clips: Provide impact clip system designed to absorb impact forces against acoustical panels in Gymnasiums.
7. Aluminum cap for use over steel grid in kitchen areas or where shown on drawings or required.

B. Metal Suspension Systems:
   1. Wide Face, Steel Capped, Double Web, Steel Suspension System:
      dd. Main and cross runners roll formed from cold rolled steel sheet; prepainted, electrolytically zinc coated, or hot dip galvanized according to ASTM A653/A653M, not less than G30 (Z90) coating designation; with prefinished 15/16 inch (24 mm)

wide metal caps on flanges:
1) Structural Classification: Heavy duty system.
2) Face Design: Flat, flush.
3) Cap Finish: Color selected by Architect.

2. Narrow Face, Steel Capped, Double Web, Steel Suspension System:
ee. Main and cross runners roll formed from cold rolled steel sheet; prepainted, electrolytically zinc coated, or hot dip galvanized according to ASTM A653/A653M, not less than G30 (Z90) coating designation; with prefinished, cold rolled, 9/16 inch (15 mm) wide metal caps on flanges:
1) Structural Classification: Intermediate-duty system.
2) Face Design: Flat, flush.
3) Cap Finish: Color selected by Architect.

2.3 ACOUSTICAL PANELS

A. Acoustic Panel Type I:
1. Basis of Design Product: School Zone Fine Fissured No. 1713 by Armstrong World Industries.
2. Classification - Provide panels complying with ASTM E1264 for type, form, and pattern:
a. Type and Form: Type III, mineral base with painted finish; Form 2, water felted.
b. Pattern: CE (perforated, small holes and lightly textured).
3. Color: White.
4. LR: Not less than 0.85.
5. NRC: Not less than 0.70.
6. CAC: Not less than **35**.
7. Edge/Joint Detail: Square.
8. Thickness: 3/4 inch (19 mm).
9. Modular Size: 24 by 24 inches (610 by 610 mm).
10. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D3273 and evaluated according to ASTM D3274 or ASTM G21.
11. Typical Location: Primary learning areas and classrooms.

B. Acoustic Panel Type II:
1. Basis of Design Product: Painted Nubby Open Plan No. 3102 by Armstrong World Industries.
2. Classification - Provide panels complying with ASTM E1264 for type, form, and pattern:
a. Type and Form: Type XII, glass fiber base with membrane faced overlay; Form 2, cloth.
b. Pattern: E (lightly textured).
c. Color: White.
3. LR: Not less than 0.84.
4. NRC: Not less than 0.95.
5. Edge/Joint Detail: Square.
6. Thickness: 1 inch (25 mm).
7. Modular Size: 24 by 24 inches (610 by 610 mm).
8. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D3273 and evaluated according to ASTM D3274 or ASTM G21.
9. Typical Location: Music rooms, performing arts rooms.

C. Acoustic Panel Type III:

1. Basis of Design Product: Clean Room VL No. 868 by Armstrong World Industries.
2. Classification - Provide panels complying with ASTM E1264 for type, form, and pattern:
   a. Type and Form: Type IV, mineral base with membrane faced overlay; washable vinyl film overlay.
   b. Pattern: GH (smooth and printed).
   c. Color: White.
3. LR: Not less than 0.80.
4. CAC: Not less than 40.
5. Edge/Joint Detail: Square.
6. Thickness: 5/8 inch (15 mm).
7. Modular Size: 24 by 24 inches (610 by 610 mm).
8. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D3273 and evaluated according to ASTM D3274 or ASTM G21.
9. Typical Location: Food preparation areas.

2.4 MOLDING, TRIM AND ACCESSORIES

A. Shadow Molding: Where an acoustical lay in ceiling abuts a gypsum board ceiling in the same plane, provide a "W" shaped reveal or "shadow" molding similar to Armstrong Shadow Molding No. 7873.

B. Light Fixture Protection:
   1. Manufacturer: Thermafiber Light Protection Kit by Owens Corning or Type 5/8 or 3/4 P(S) by Armstrong World Industries.
   2. Fire Resistance Rating: Same as ceiling assembly rating.
   3. Locations: At fixtures reinstalled in fire rated ceiling assemblies.

C. Roll Formed, Sheet Metal Edge Moldings and Trim:
   1. Type and profile for standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color used for exposed flanges of suspension system runners:
      a. Provide edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners unless otherwise indicated.
      b. For lay in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
      c. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

D. Extruded Aluminum Edge Moldings and Trim:
   1. Where indicated, provide extruded aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements and the following:
      a. Aluminum Alloy: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of aluminum extrusions complying with ASTM B221 for Alloy and Temper 6063-T5.
      b. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.
      c. Baked Enamel or Powder Coat Finish: Minimum dry film thickness of 1.5 mils (0.04 mm). Comply with ASTM C635/C635M and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

E. Acoustical Sealant:
   1. Comply with ASTM C834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E90:
      a. Exposed and Concealed Joints: Nonsag, paintable, nonstaining latex sealant.
      b. Concealed Joints: Nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic rubber sealant.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

A. Environmental Limitations:
   1. Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use:
      a. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

3.2 EXTRA MATERIALS

A. Furnish extra materials matching products installed and packaged with protective covering for storage and identified with labels describing contents:
   1. Acoustical Ceiling Panels: Full size panels equal to 2 percent of quantity installed.
   2. Suspension System Components: Quantity of each exposed component equal to 2 percent of quantity installed.
   3. Hold Down Clips: Equal to 2 percent of quantity installed.
   4. Impact Clips: Equal to 2 percent of quantity installed.

3.3 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut for compliance with requirements specified that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation after correcting unsatisfactory conditions.

3.4 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less than half width panels at borders, and comply with layout shown on reflected ceiling plans.

3.5 INSTALLATION

A. Install acoustical panel ceilings to comply with ASTM C636/C636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA *Ceiling Systems Handbook*:
   1. Fire Rated Assembly: Install fire-rated ceiling systems according to tested fire rated design.

B. Suspend ceiling hangers from building's structural members and as follows:
   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
   2. Splay hangers where required and, if permitted with fire resistance rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
   4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
   5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
   6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast in place hanger inserts, postinstalled mechanical or adhesive anchors, or power actuated fasteners that extend through forms into concrete.
   7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
   8. Do not attach hangers to steel deck tabs.
   9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
   10. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
   11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast in place or postinstalled anchors.

D. Panel Accessibility: Install panels downward accessible by disengaging hinge support rail on one side of panel from the T Bar Flange or optional A Mount rail flange without the use of tools, for access without removal of panel from the ceiling.

E. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels:
   1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
   2. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.
   3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

F. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

G. Install acoustical panels with undamaged edges and fit accurately into suspension system

runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit:

1. Arrange directionally patterned acoustical panels with pattern running in one direction parallel to long axis of space.
2. For square edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
3. For reveal edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
4. For reveal edged panels on suspension system members with box shaped flanges, install panels with reveal surfaces in firm contact with suspension system surfaces and panel faces flush with bottom face of runners.
5. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
6. Install hold-down clips in areas indicated, in areas with exterior opening larger than 48” x 96”, where required by authorities having jurisdiction, and for fire resistance ratings; space as recommended by panel manufacturer's written instructions unless otherwise indicated.
7. Install clean room gasket system in areas indicated, sealing each panel and fixture as recommended by panel manufacturer's written instructions.
8. Protect lighting fixtures and air ducts to comply with requirements indicated for fire resistance rated assembly.

3.6 FIRE RATING SCHEDULE

A. Refer to UL Assemblies Drawings for Fire Rating requirements of ceiling materials at rated floor and roof assemblies.

3.7 FIELD QUALITY CONTROL

A. Special Inspections:
   1. Engage a qualified special inspector to perform the following special inspections:
      a. Compliance of seismic design.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and prepare test reports.

C. Perform the following tests and inspections of completed installations of acoustical panel ceiling hangers and anchors and fasteners in successive stages. Do not proceed with installations of acoustical panel ceiling hangers for the next area until test results for previously completed installations show compliance with requirements:
   1. Extent of Each Test Area:
      a. When installation of ceiling suspension systems on each floor has reached 20 percent completion but no panels have been installed:
         1) Within each test area, testing agency will select one of every 10 power-actuated fasteners and postinstalled anchors used to attach hangers to concrete and will test them for 200 lbf (890 N) of tension; it will also select one of every two postinstalled anchors used to attach bracing wires to concrete and will test them for 440 lbf (1957 N) of tension.
         2) When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.

D. Acoustical panel ceiling hangers and anchors and fasteners will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.8 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 51 00

SECTION 09 65 20 - RESILIENT BASE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes: Requirements including but not limited to:
   1. Rubber base.
   2. Accessories necessary for a complete installation.

1.3 SUBMITTALS

A. Product Data: Technical data for each type of product including manufacturer's installation instructions.

B. Samples: Sample of Base Selected or Color Chart if none selected.

C. Maintenance Data: Submit for inclusion in maintenance manuals.

D. Extra Stock: Provide 20 feet of each.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Entity having minimum 5 years documented experience who employs workers competent in techniques required by manufacturer for floor tile installation and seaming method indicated.

B. Interior floor-wall base that is 6 inches (152mm) or less in height shall be tested in accordance with Section 804.2 and shall be not than Class II. Where a Class I floor finish is required, the floor-wall base shall be Class I.
   1. Exception: Interior trim material that comply with Section 806.7

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store base and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 degrees F (10 degrees C) or more than 85 degrees F (29 degrees C). Store floor tiles on flat surfaces.

1.6 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 degrees F (21 degrees C) or more than 85 degrees F (29 degrees C), in spaces to receive floor tile during the following time periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 degrees F (13 degrees C) or more than 95 degrees F (35 degrees C).

C. Close spaces to traffic for 48 hours after installation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Basis of Design Product: Manufacturers and tile series, pattern, and color selections are indicated in the Finish Schedule and are a basis of design. Subject to compliance with requirements, provide product indicated in Finish Schedule or comparable product by one of the following:
1. Burke Mercer.
2. Johnsite, a division of Tarkett Group.
3. Roppe Rubber Corporation.
4. Or approved equal.

B. Rubber Base: ASTM F1861.
1. Material: Rubber, vulcanized, Type TS, Group I.
2. Manufacturing Method: Group I (solid, homogeneous).
3. Style: Topset cove; minimum 100 foot coil, cut to length required.
4. Minimum Thickness: 0.125 inch (3.2 mm).
5. Color: Selected by Architect.
6. Height: 4 inches, unless indicated otherwise.
7. Outside Corners: Pre-formed.
8. Inside Corners: Pre-formed.

C. Adhesives: Water resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for maximum moisture content and other conditions affecting performance of the work.
1. Verify that finishes of substrates comply with tolerances and other requirements specified for other work and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

B. Proceed with installation after correcting unsatisfactory conditions. Installation of resilient flooring and accessories indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Immediately before installation, sweep clean substrates to be covered by resilient base.

3.3 INSTALLATION

A. Comply with manufacturer's written instructions for installing flooring. Scribe and cut flooring to butt neatly and tightly to vertical surfaces, permanent fixtures, and built in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Extend flooring into toe spaces, door reveals, closets, and similar openings.

B. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on flooring as marked on substrates. Use chalk or other nonpermanent marking device.

C. Resilient Base: Comply with manufacturer's written instructions for installing resilient base. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
   1. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
   2. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
   3. Do not stretch resilient base during installation.
   4. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
   5. Preformed Corners: Install preformed corners before installing straight pieces.
   6. Job Formed Corners: Not allowed.

END OF SECTION 09 65 20

SECTION 09 65 43 – RESILIENT FLOORING – LINOLEUM FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Flooring and accessories as shown on the drawings and schedules and as indicated by the requirements of this section.

B. Related Documents
1. Drawings and General Provisions of the Contract (including General and Supplementary Conditions and Division 1 sections) apply to the work of this section.

C. Related Sections:
1. Division 3 Concrete
2. Division 6 Wood and Plastics
3. Division 7 Thermal and Moisture Protection
4. Division 9 Finishes

1.2 REFERENCES

A. ASTM International:
1. ASTM E 648 Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
2. ASTM E 662 Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials
3. ASTM F 710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
4. ASTM F 1482, Standard Guide to Wood Underlayment Products Available for Use Under Resilient Flooring
5. ASTM F 1861 Standard Specification for Resilient Wall Base
6. ASTM F 1869 Standard Test Method for Measuring Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
7. ASTM F 2034 Standard Specification for Sheet Linoleum Floor Covering
8. ASTM F 2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes

B. National Fire Protection Association (NFPA):
1. NFPA 253 Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source
2. NFPA 258 Standard Test Method for Measuring the Smoke Generated by Solid Materials

1.3 SYSTEM DESCRIPTION

A. Performance Requirements: Provide flooring which has been manufactured, fabricated and installed to performance criteria certified by manufacturer without defects, damage, or failure.

B. Administrative Requirements
1. Pre-installation Meeting: Conduct an on-site pre-installation meeting to verify project requirements, substrate conditions, manufacturer’s installation instructions and

manufacturer's warranty requirements. Comply with Division 1 Project Management and Coordination (Project Meetings) Section.

2. Pre-installation Testing: Conduct pre-installation testing as follows:
   a. Moisture tests
   b. Bond test
   c. pH test

C. Sequencing and Scheduling
1. Install flooring and accessories after the other finishing operations, including painting, have been completed. Close spaces to traffic during the installation of the flooring.
2. Do not install flooring over concrete slabs until they are sufficiently dry to achieve a bond with the adhesive, in accordance with the manufacturer's recommended bond, moisture tests and pH test.

1.4 SUBMITTALS

A. Submit shop drawings, seaming plan, coving details, and manufacturer's technical data, installation and maintenance instructions for flooring and accessories.

B. Submit the manufacturer's standard samples showing the required colors for flooring, welding rods, and applicable accessories.

C. Submit Safety Data Sheets (SDS) available for flooring products, adhesives, weld rod, patching/leveling compounds, floor finishes (polishes) and cleaning agents.

D. Closeout Submittals: Submit the following:
1. Operation and Maintenance Data: Operation and maintenance data for installed products in accordance with Division 1 Closeout Submittals (Maintenance Data and Operation Data) Section. Include methods for maintaining installed products, and precautions against cleaning materials and methods detrimental to finishes and performance.
2. Warranty: Warranty documents specified herein

1.5 QUALITY ASSURANCE

A. Single-Source Responsibility: provide types of flooring and accessories supplied by one manufacturer, including leveling and patching compounds, and adhesives.

B. Select an installer who is competent in the installation of linoleum sheet flooring using heat-welded seams.

C. Fire Performance Characteristics: Provide resilient linoleum sheet flooring with the following fire performance characteristics as determined by testing material in accordance with ASTM test methods indicated below by a certified testing laboratory or other testing agency acceptable to authorities having jurisdiction:
1. ASTM E 648 Critical Radiant Flux of 0.45 watts per sq. cm. or greater, Class I
2. ASTM E 662 (Smoke Generation) Maximum Specific Optical Density of 450 or less
3. CAN/ULC-S102.2 – Flame Spread Rating and Smoke Developed – Results as tested

D. Resilient Flooring shall be stable, firm, and slip resistant CBC Section 11B-302.1

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with Division 1 Product Requirements Sections

B. Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

C. Deliver materials in good condition to the jobsite in the manufacturer's original unopened containers that bear the name and brand of the manufacturer, project identification, and shipping and handling instructions.

D. Store materials in a clean, dry, enclosed space off the ground, protected from harmful weather conditions and at temperature and humidity conditions recommended by the manufacturer. Protect adhesives from freezing. Store flooring, adhesives and accessories in the spaces where they will be installed for at least 48 hours before beginning installation.

1.7 PROJECT CONDITIONS

A. Maintain a minimum temperature in the spaces to receive the flooring and accessories of 65ºF (18ºC) and a maximum temperature of 85ºF (29ºC) for at least 48 hours before, during, and for not less than 48 hours after installation. Thereafter, maintain a minimum temperature of 55ºF (13ºC) in areas where work is completed. Protect all materials from the direct flow of heat from hot-air registers, radiators, or other heating fixtures and appliances.

1.8 LIMITED WARRANTY

A. Resilient Flooring: Submit a written warranty executed by the manufacturer, agreeing to repair or replace resilient flooring that fails within the warranty period.

B. Limited Warranty Period: 5 years

C. The Limited 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.

1.9 MAINTENANCE

A. Extra Materials: Deliver extra materials to Owner. Furnish extra materials from same production run as products installed. Packaged with protective covering for storage and identified with appropriate labels.
   1. Quantity: Furnish quantity of flooring units equal to 2% of amount installed or 40 square feet, whichever is greater.
   2. Delivery, Storage and Protection: Comply with Owner's requirements for delivery, storage and protection of extra material.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Resilient sheet flooring, adhesives, and accessories:
   1. Armstrong Flooring, Inc., Lancaster, PA.
   2. Forbo Flooring Systems, Hazelton, PA.
   3. Johnsonite, Solon, OH.
   4. Or approved equal.

2.2 RESILIENT SHEET FLOORING MATERIALS

A. Provide Linoleum Sheet Flooring:
1. Basis of Design: Johnsonite, Veneto Harmonium.
2. Description: The product shall consist of a polyurethane-coated homogeneous mixture of linoleum cement (linseed oil, natural tree resins, drying oil catalysts), wood flour, limestone, color pigments mixed and calendered onto a jute fabric backing. Colors and pattern detail shall be dispersed throughout the thickness of the wear layer.
3. Linoleum sheet shall conform to the requirements of ASTM F 2034, Type I, “Standard Specification for Sheet Linoleum Floor Covering Without Backing"
4. Pattern and Color: Refer to Drawings.
5. Width: 6 ft. 6 in. (2.0 m)
6. Length: Up to 98.4 ft. (30 m)
7. Thickness: 0.100 in. (2.5 mm)

B. Linoleum Weld Rod:
1. Provide solid color linoleum weld rod intended for heat welding of seams. Color shall be compatible with field color of flooring or as selected by Architect to contrast with field color of flooring. Color selected from the range currently available from manufacturer.

C. Seam Adhesive:
1. Provide seam adhesive at seams as recommended by the resilient flooring manufacturer.

2.3 WALL BASE MATERIALS

A. For Integral Flash Cove Base: Extend sheet flooring 4 inches (10.16 cm) up the wall using adhesive, welding rod, and accessories recommended and approved by the flooring manufacturer.

B. For Top Set Wall Base: Refer to Section 09 65 20.

2.4 ADHESIVES

A. Provide High-Performance Epoxy Flooring Adhesive for field as recommended by the flooring manufacturer.

B. Provide Seam Adhesive at seams as recommended by the resilient flooring manufacturer.

2.5 ACCESSORIES

A. Provide transition/reducing strips tapered to meet abutting materials.

B. Provide threshold of thickness and width as shown on the drawings.

C. Provide resilient edge strips of width shown on the drawings, of equal gauge to the flooring, homogeneous vinyl or rubber composition, tapered or bullnose edge, with color to match or contrast with the flooring, or as selected by the Architect from standard colors available.

D. Provide metal edge strips of width shown on the drawings and of required thickness to protect exposed edges of the flooring. Provide units of maximum available length to minimize the number of joints. Use butt-type metal edge strips for concealed anchorage, or

overlap-type metal edge strips for exposed anchorage. Unless otherwise shown, provide strips made of extruded aluminum with a mill finish.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's product data, including technical bulletins, product catalog, installation instructions, and product carton instructions for installation and maintenance procedures as needed.

3.2 EXAMINATION

A. Site Verification of Conditions: Verify substrate conditions (which have been previously installed under other sections) are acceptable for product installation in accordance with manufacturer's instructions (i.e. moisture tests, bond test, pH test, etc.).

B. Visually inspect flooring materials, adhesives and accessories prior to installation. Flooring material with visual defects shall not be installed and shall not be considered as a legitimate claim.

C. Examine subfloors prior to installation to determine that surfaces are smooth and free from cracks, holes, ridges, and other defects that might prevent adhesive bond or impair durability or appearance of the flooring material.

D. Inspect subfloors prior to installation to determine that surfaces are free from curing, sealing, parting and hardening compounds; residual adhesives; adhesive removers; and other foreign materials that might prevent adhesive bond. Visually inspect for evidence of moisture, alkaline salts, carbonation, dusting, mold, or mildew.

E. Report conditions contrary to contract requirements that would prevent a proper installation. Do not proceed with the installation until unsatisfactory conditions have been corrected.

F. Failure to call attention to defects or imperfections will be construed as acceptance and approval of the subfloor. Installation indicates acceptance of substrates with regard to conditions existing at the time of installation.

3.3 PREPARATION

A. Subfloor Preparation: Smooth concrete surfaces, removing rough areas, projections, ridges, and bumps, and filling low spots, control or construction joints, and other defects with Cement-Based Patch, Underlayment and Embossing Leveler/Underlayment Additive as recommended by the flooring manufacturer.

B. Subfloor Cleaning: The surface shall be free of dust, solvents, varnish, paint, wax, oil, grease, sealers, release agents, curing compounds, residual adhesive, adhesive removers and other foreign materials that might affect the adhesion of resilient flooring to the concrete or cause a discoloration of the flooring from below. Remove residual adhesives as recommended by the flooring manufacturer. Remove curing and hardening compounds not compatible with the adhesives used, as indicated by a bond test or by the compound manufacturer's recommendations for flooring. Avoid organic solvents. Spray paints, permanent markers and other indelible ink markers must not be used to write on the back of the flooring material or used to mark the concrete slab as they could bleed through, telegraphing up to the surface and permanently staining the flooring material. If these

contaminants are present on the substrate they must be mechanically removed prior to the installation of the flooring material.

C. When using Adhesive, perform subfloor moisture testing in accordance with ASTM F 2170, "Standard Test Method for Determining Relative Humidity in Concrete Slabs Using *in-situ* Probes" and Bond Tests to determine if surfaces are dry; free of curing and hardening compounds, old adhesive, and other coatings; and ready to receive flooring. Relative humidity shall not exceed 90%. Do not proceed with flooring installation until results of moisture tests are acceptable. All test results shall be documented and retained.

D. Concrete pH Testing: Perform pH tests on concrete floors regardless of their age or grade level. All test results shall be documented and retained.

E. Wood Subfloor - Surface Cleaning: Make subfloor free from dust, dirt, grease, and all foreign materials.
1. Check panels for sources of discoloration such as contamination from paint, varnish, stain overspray or spills, plumbing sealers, asphalt, heater fuel, markers or potential staining agents such as wood or bark not visible on the surface, edge sealers, logo markings, printed nail patterns and synthetic patches.
2. Remove old adhesive.
3. Cover adhesive, oil or wax residue with an appropriate underlayment. If the residue is tacky, place a layer of felt or polyethylene sheeting over it to prevent a cracking sound when walking on the floor.
4. Remove all paint, varnish, oil and wax from all subfloors.
5. Vacuum or broom-clean surfaces to be covered immediately before the application of flooring

3.4 INSTALLATION OF FLOORING

A. Install flooring wall to wall before the installation of floor-set cabinets, casework, furniture, equipment, movable partitions, etc. Extend flooring into toe spaces, door recesses, closets, and similar openings as shown on the drawings.

B. If required, install flooring on pan-type floor access covers. Maintain continuity of color and pattern within pieces of flooring installed on these covers. Adhere flooring to the subfloor around covers and to covers.

C. Scribe, cut, and fit or flash cove to permanent fixtures, columns, walls, partitions, pipes, outlets, and built-in furniture and cabinets.

D. Adhere flooring to the subfloor without cracks, voids, raising and puckering at the seams. Roll with a 100-pound (45.36 kilogram) roller in the field areas. Hand-roll flooring at the perimeter and the seams to assure adhesion. Refer to specific rolling instructions of the flooring manufacturer.

E. Lay flooring to provide a minimum number of seams. Avoid cross seams, filler pieces, and strips. Match edges for color shading and pattern at the seams in compliance with the manufacturer's recommendations.

F. Install flooring with adhesives, tools, and procedures in strict accordance with the manufacturer's written instructions. Observe the recommended adhesive trowel notching, open times, and working times.

G. Prepare heat-welded seams with special routing tool supplied for this purpose and heat weld with linoleum welding rod in seams. Use methods and sequence of work in

conformance with written instructions of the flooring manufacturer. Finish all seams flush and free from voids, recesses, and raised areas.

3.5 INSTALLATION OF ACCESSORIES

A. Place resilient edge strips tightly butted to flooring, and secure with adhesive recommended by the edge strip manufacturer. Install edge strips at edges of flooring that would otherwise be exposed.

3.6 CLEANING

A. Perform initial and on-going maintenance according to manufacturer's recommendations.

3.7 PROTECTION

A. Protect installed flooring as recommended by the flooring manufacturer against damage from rolling loads, other trades, or the placement of fixtures and furnishings.

END OF SECTION 09 65 43

SECTION 09 68 00 - CARPETING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes: Requirements including but not limited to:
   1. Carpet and pad.
   2. Accessories necessary for a complete installation.

1.3 SUBMITTALS

A. Product Data: Technical data including installation recommendations for each type of substrate:
   1. Carpet: For each type indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance.

B. Samples: For each products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
   1. Carpet: 12 inch (300 mm) square Sample from approved color and product of carpet.
   2. Exposed Edge, Transition, and Other Accessory Stripping: 12 inch (300 mm) long Samples.
   3. Carpet Seam: 6 inch (150 mm) Sample.
   4. Mitered Carpet Border Seam: 12 inch (300 mm) square Sample. Show carpet pattern alignment.
   5. Carpet base and accessory samples.

C. Product Test Reports: For carpet and carpet cushion, for tests performed by a qualified testing agency.

D. Shop Drawings: Showing extent of product, seam direction, and location and type of carpet accessories. Submittal to indicate columns, doorways, enclosing walls or partitions, casework, and locations where cutouts are required.

E. Maintenance Data: For carpet to include in maintenance manuals. Include the following:
   1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
   2. Precautions for cleaning materials and methods that could be detrimental to carpet and carpet cushion.

1.4 QUALITY ASSURANCE

1. Fire Test Response Characteristics: Provide products with the critical radiant flux classification determined by testing identical products in accordance with ASTM E 648. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.
2. Accessibility Requirements: Comply with applicable requirements.
   a. CBC 2022 California Building Code (CCR Title 24, Part 2, as adopted and amended by DSA).

1) CBC Chapter 11B, Access to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing.

3. AQMD - Air Quality Management District, Local Regulations.
4. SCAQMD – South Coast Air Quality Management District Regulations Rule 1168 Adhesive and Sealant Applications.
5. CRI – Carpet and Rug Institute Green Label Plus.
6. Carpet shall have level loop, textured loop, or level-cut/uncut pile texture, firm cushion, pad or backing (or no cushion or pad) and maximum pile height of 1/2 inch in accordance with CBC Section 11B-302.2. Carpet edges shall comply with CBC 11B-302.2 and carpet trim to CBC Section 11B-303.

B. Installer Qualifications: Installer having minimum 5 years documented experience as a commercial carpet installer, who is certified by the International Certified Floorcovering Installers Association at the Commercial II or higher certification level.

C. Contractor is required to achieve the specified concrete moisture content prior to installation of all flooring materials or use a flooring manufacture approved moisture barrier prior to installation of all flooring products.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104.

B. Store in a dry location between 65 degrees F and 90 degrees F and a relative humidity below 65%. Protect from damage and soiling. Stack carpet rolls horizontally, elevated above slab level on a flat surface, stacked no higher than two rolls.

C. Store materials in area of installation for minimum period of 48 hours prior to installation.

D. Protect carpet from damage, dirt, stains, and moisture.

1.6 FIELD CONDITIONS

A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet and carpet cushion until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.

C. Do not install carpet and carpet cushion over concrete slabs until slabs have cured, are sufficiently dry to bond with adhesive, and have pH range recommended by carpet manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet, install carpet before installing these items.

1.7 WARRANTY

A. Carpet: Written warranty in which manufacturer agrees to repair or replace components of carpet installation that fail in materials or workmanship within specified warranty period.
1. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, loss of tuft bind strength, dimensional stability, excessive surface wear, excess static discharge, and delamination.

3. Warranty Period: 25 years from date of Substantial Completion.

1.8 PRE-INSTALLATION CONFERENCE

A. Refer to Section 01 31 19 – Project Meetings.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Basis of Design: Carpet series and patterns indicated on Finish Schedule. Subject to compliance with requirements, provide products by one of the following;
   1. Tandus-Centiva
   2. Or approved equal.

B. Rubber Base: As specified in Section 09 65 20.

C. Carpet:
   1. Performance:
      a. Appearance Retention Rating: Severe traffic, 3.5 minimum according to ASTM D 7330.
      b. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm according to NFPA 253.
      c. Dry Breaking Strength: Not less than 100 lbf (445 N) according to ASTM D 2646.
      d. Delamination: Not less than 4 lbf/in. (18 N/mm) per ASTM D 3936.
      e. Tuft Bind: Not less than 5 lbf (22 N) according to ASTM D 1335.
      f. Colorfastness to Crocking: Not less than 4, wet and dry, according to AATCC 165.
      g. Resistance to Insects: Comply with AATCC 24.
      h. Colorfastness to Crocking: Not less than 4, wet and dry, per AATCC 165.
      i. Colorfastness to Light: Not less than 4 after 40 AFU (AATCC fading units) according to AATCC 16, Option E.
      j. Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria; not less than 1-mm halo of inhibition for gram-negative bacteria; no fungal growth; per AATCC 174.
      k. Electrostatic Propensity: Less than 3.5 kV according to AATCC 134.
      l. Emissions: Provide carpet that complies with testing and product requirements of CRI Green Label Plus.
      m. Backing: Standard with manufacturer.
   2. Face Construction:
      a. Width: Six (6) feet.
      b. Construction: Level Loop.
      c. Gauge: 1/13.
      d. Pile Units per Inch: 8.2.
      e. Pile Height Average: 0.117 inch.
      f. Tuft Density: 104.96.
      g. Cushion Roll Goods (RS), Total Weight: 81.0 ounces per square yard.
      h. Fiber Content: TDX Nylon Type 6,6.
      i. Dye Method: 50% Solution Dyed/50% Yarn Dyed.
   3. Basis of Design: Powerbond Cushion Backing System by Tandus.
      a. Primary Tufting Substrate: Synthetic nonwoven.
      b. Fusion Coat: Sealant Vinyl.
      c. Backing: Closed-Cell Vinyl Cushion
         1) Weight: 35.5 ounces per square yard.
         2) Density: 18.5 lbs. per cubic foot.
         3) Thickness: 5/32 inch.
         4) Compression Set: Maximum 10 percent.

5) Compression Deflection:
a) Maximum 7 lbs. per square inch at 25 percent.
b) Maximum 25 lbs. per square inch at 25 percent.

d. Adhesive System: Microencapsulated Tackfier applied to 100 percent during manufacturing.

4. Total Product Weight: RS 83.0 ounces per square yard plus or minus 5 percent. Product Testing Information:
   a. Surface Flammability: Passes CPSC FF-1-70. (ASTM D2859)
   b. Flooring Radiant Panel: Class 1 (mean average CRF: 0.45 watts per square centimeter or higher. (ASTM E648)
   c. Electrostatic Propensity: 3.0 kV or lower. Permanent Conductive Fiber. (AATCC 134)
   d. Color(s): As indicated on drawings.
   e. Locations: Indicated on drawings.
5. Style: Abrasive Action II manufactured by Tandus Commercial Floor Systems.

D. Entry Mat System:
1. Basis of Design Product/Manufacturer: “Abrasive Action” as manufactured by Tandus (Collins and Aikman) Commercial Floor Systems, Dalton GA; (404) 259-9711.
2. Type: Patterned carpet tiles.
3. Construction: Accuweave patterned Loop
4. Color: Charcoal
5. Locations: As shown on drawings.

E. Applied Soil Resistance Treatment: Standard with manufacturer.

F. Antimicrobial Treatment: Standard with manufacturer.

G. Adhesives: Water resistant, mildew resistant, nonstaining, pressure sensitive type to suit products and subfloor conditions indicated, complying with flammability requirements for installed carpet and is recommended by carpet manufacturer for releasable installation.

H. Trowelable Leveling and Patching Compounds: Latex modified, hydraulic cement based formulation provided or recommended by carpet cushion manufacturer.

I. Adhesives: Water resistant, mildew resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and is recommended or provided by carpet and carpet cushion manufacturers.

J. Seam Adhesive: Hot melt adhesive tape or similar product recommended by carpet manufacturer for sealing and taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.

K. Metal Edge/Transition Strips: Extruded aluminum with mill finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

L. Extra Carpet: After completion of the carpet installation, the carpet subcontractor shall provide an additional three (3) percent of total yards installed of each carpet specified to the Owner for future carpet replacement that may be required. This extra stock is to be unused rolls, tiles, and mats and does not include scraps.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance. Examine carpet for type, color, pattern, and potential defects.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
   1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond.
   2. Prior to delivery of flooring materials, contractor shall conduct Calcium Chloride “dome” test to verify that concrete floors are dry with maximum moisture vapor emissions of 3 lbs. per 1000 square feet. in 24 hours, and exhibit negative alkalinity, carbonation or dusting. Apply 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.
   3. Prior to delivery of carpeting, conduct Relative Humidity Test Method in accordance with ASTM F 2170 using a Wagner Rapid RH probe to verify relative humidity and surface pH of concrete floor slabs, the method:
      a. 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).
      b. Place probe to full depth of test hole, place cap over probe.
      c. Permit test site to acclimate, or equilibrate, for 72 hours prior to taking relative humidity readings.
      d. Remove cap and press button on the probe to obtain reading.
      e. Relative humidity readings for substrates receiving non-permeable flooring are 75% or lower.
   4. 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.
   5. Alkalinity Testing: Concrete floors shall be tested for alkalinity prior to installation of flooring. Levels of pH shall not exceed written recommendations of flooring manufacturer or adhesive manufacturer, or both.
   6. Delivery of flooring materials and beginning of installation means acceptance of existing substrate and site conditions.
   7. Subfloor finishes comply with requirements specified in Section 03 30 00 Cast-In-Place Concrete for slabs receiving carpet.
   8. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
   9. 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.

C. Proceed with installation after correcting unsatisfactory conditions.

3.2 PREPARATION

A. Comply with CRI 104, Section 7.3 *Site Conditions; Floor Preparation* and with carpet manufacturer's written installation instructions for preparing substrates.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider, and protrusions more than 1/32 inch (0.8 mm), unless more stringent requirements are required by manufacturer's written instructions.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet and cushion manufacturer.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet.

3.3 INSTALLATION

A. Comply with CRI 104 and carpet and carpet cushion manufacturer written installation instructions for the following:
   1. Direct Glue Down Installation: Comply with CRI 104, Section 9 *Direct Glue Down Installation*.

B. Comply with carpet manufacturer's written recommendations and Shop Drawings for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.
   1. Do not bridge building expansion joints with carpet.
   2. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.
   3. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

C. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

D. Install pattern parallel to walls and borders to comply with CRI 104, Section 15, *Patterned Carpet Installations* and with carpet manufacturer's written recommendations.

E. Install in accordance with CBC Section 11B-302.2.
   1. Carpet shall be securely attached and shall have a firm cushion, pad, or backing or no cushion pad. It shall have a level loop, level cut pile, or level cut/uncut pile texture. Pile height shall be ½" maximum.
   2. Exposed edges shall be fastened to floor surfaces and shall have trim on the entire length. Carpet edges shall comply with CBC Section 11B-303.

3.4 CLEANING AND PROTECTING

A. Perform cleaning operations immediately after installing carpet:
   1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
   2. Remove yarns that protrude from carpet surface.
   3. Vacuum carpet using commercial machine with face beater element.

B. Protect installed carpet to comply with CRI 104, Section 16, *Protecting Indoor Installations*.

C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet manufacturer and carpet cushion manufacturer.

END OF SECTION 09 68 00

SECTION 09 90 00 - PAINTINGS AND COATINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes: Requirements including but not limited to:
   1. Surface preparation and field painting of exposed items and surfaces.
   2. Field preparation and painting of factory primed metal products and fabrications.
   3. Accessories necessary for a complete installation,

1.3 DEFINITIONS

A. Standard coating terms defined in ASTM D 16 apply.
   1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85 degree meter.
   2. Eggshell refers to low sheen finish with a gloss range between 20 and 35 when measured at a 60 degree meter.
   3. Semigloss refers to medium sheen finish with a gloss range between 35 and 70 when measured at a 60 degree meter.
   4. Full gloss refers to high sheen finish with a gloss range more than 70 when measured at a 60 degree meter.

1.4 SUBMITTALS

A. Product Data: Submit technical data and information for block fillers, primers, paints, and coatings, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.
   1. Indicate manufacturer's instructions for special surface preparation procedures, substrate conditions requiring special attention.
   2. Material List: Provide inclusive list of required coating materials. Indicate each material and cross reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number, series, and general classification.
   3. Submit Zero VOC and/or SCAQMD compliant products only.

B. Samples: Submit for each type of paint system and in each color and gloss of topcoat.
   1. Provide stepped samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing samples for review. Resubmit until required sheen, color, and texture are achieved.
   2. Provide list of material and application for each coat of each sample. Label each sample as to location and application.
   3. Submit samples on following substrates for review of color and texture only:
      a. Concrete: Provide two 4 inch square samples for each color and finish.
      b. Concrete Masonry: Provide two 4" x 8" samples of masonry, with mortar joint in the center, for each finish and color.
      c. Painted Wood: Provide two 12 inch square samples of each color and material on hardboard.
      d. Ferrous and Nonferrous Metals: Provide two 4 inch square samples of flat metal and two 8 inch long samples of solid metal for each color and finish.

C. Product List: Submit list of including each paint system, color, and location of application. Use same product and location designations indicated in Finish Schedule.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
1. Comply with Federal and local toxicity and air quality regulations and with Federal requirements on content of for heavy metals including but not limited to: lead and mercury. Do not use solvents in paint products that contribute to air pollution.
2. Comply with SCAQMD Rule1113 -7/01/2007
3. Performance and Durability:
   a. ASTM D 16 Standard Test Method for Load Testing Refractory Shapes at High Temperatures.
   b. ASTM D 2486 Standard Test Method for Scrub Resistance of Interior Wall Paint.
   c. ASTM D 2805 Standard Test Method for Hiding Power of Paints by Reflectometry.
   d. ASTM D 4828 Standard Test Method for Practical Washability of Organic Coatings.

B. Applicator Qualifications: A firm or individual having minimum 5 years documented experience in applying paints and coatings similar in material, design, and extent to those indicated.

C. Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well ventilated areas with ambient temperatures continuously maintained at not less than 45 degrees F (7 degrees C).
1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

A. Apply waterborne paints when temperatures of surfaces to be painted and surrounding air are between 50 degrees F and 90 degrees F (10 degrees and 32 degrees C).

B. Do not thin or add water to water based paints, including water based alkyds.

C. Weather Conditions:
1. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
2. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 degrees F (3 degrees C) above dew point; or to damp or wet surfaces.
3. Minimum Application Temperatures for Water based Paints: Between 50 degrees F (10 degrees C) and 90 degrees F (32 degrees C).

D. Apply solvent thinned paints when temperatures of surfaces to be painted and surrounding air are between 45 degrees F. and 95 degrees F (7 degrees F and 35 degrees C).
1. Minimum Application Temperature for Varnish Finishes: 65 degrees F (18 degrees C) for interior or exterior, unless required otherwise by manufacturer's instructions.
2. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by the manufacturer during application and drying periods.

E. Provide lighting level of 80 foot candles (860lx) measured mid-height at substrate surface.

F. Labels: Do not paint over Underwriters Laboratories, Factory Mutual, other code required labels, or equipment name, identification, performance rating, or nomenclature plates.

1.8 WARRANTY

A. Written warranty signed by the manufacturer and the installer in which the manufacture and installer agree to repair or replace paint and primers that fail within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Flaking or delamination of paint with the substrate.
      b. Rust, scale, similar imperfections due to improper surface preparation.
      c. Thinning or watering of paint beyond that considered acceptable of paint manufacturer.
      d. Failure to achieve dry film thickness (DFT) recommended by manufacturer for each coat in a paint system.
      e. Deterioration or loss of color of paint beyond normal weathering.
   2. Warranty Period: One year from date of Substantial Completion.

1.9 EXTRA MATERIALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Paint: 1 gallon (3.8 L) of each material and color applied.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Basis of Specifications: Sherwin Williams paints. Subject to compliance with requirements, provide first quality, 100% acrylic, commercial or industrial products of one of the specified manufacturers. Residential products are not permitted.
   1. Proprietary Names: Paint Schedule is based on a single manufacturer for convenience. Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that named products are required to the exclusion of comparable products of specified manufacturers. Furnish product technical data, including per cent solids by weight and volume; VOC content limits and emissions data; and certificates of performance for comparable paint products of specified manufacturer.
   2. Paint Products:
      a. Sherwin-Williams Co.
      b. Vista Paint
      c. Dunn-Edwards Corporation
      d. Or approved equal.

B. Material Compatibility: Provide each paint system including block fillers, primers, and finish coats, that are compatible with one another and with substrates indicated under conditions of service and application, demonstrated by manufacturer based on testing and field experience.

C. Material Quality: Provide manufacturer's best quality commercial paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint material containers not displaying manufacturer's product identification will not be acceptable. Residential quality paint products are not permitted.

D. Chemical Components of Interior Paints and Coatings: Provide products complying with limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24) and SCAQMD Rule1113 -7/01/2007.

1. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
2. Restricted Components: Paints and coatings shall not contain components restricted by the EPA and the SCAQMD.

E. Accessories: Materials not specifically indicated but required to achieve the finishes specified, of commercial quality.

F. Patching Materials: Latex filler compatible with paint systems.

G. Fastener Head Cover Materials: Latex filler.

H. Colors: Refer to drawings furnishing sheets and exterior elevations.

2.2 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke to engage the services of a qualified testing agency to sample paint materials.
1. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to site, samples may be taken at the site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for maximum moisture content and conditions affecting performance of the work.

B. Test substrates after repairing and cleaning substrates but prior to application of paint and coatings.
1. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
   a. Concrete: 12 percent.
   b. Fiber Cement Board: 12 percent.
   c. Masonry (Clay and CMUs): 12 percent.
   d. Wood: 15 percent.
   e. Gypsum Board: 12 percent.
   f. Plaster: 12 percent.
2. Test cementitious and plaster cement/stucco for alkalinity (pH).

C. Gypsum Board Substrates: Verify taped joints are tapes and finishing compound is sanded smooth.

D. Plaster Substrates: Verify plaster has fully cured. Verify existing plaster is in good condition and can receive new paint coating.

E. Spray Textured Ceiling Substrates: Verify surfaces are dry.

F. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
   1. Verify previously painted surfaces can be stripped to bare substrate, repaired if necessary, and prepared to receive new paint system consisting of primer and two top coats at a minimum.
      a. Note: Previously painted surfaces have failed to accept new paint systems. Determined cause of failure and take corrective measures to ensure each surface accepts new paint system. Failure of new paint system is not permitted.

G. Commence paint and coating application after correcting unsatisfactory conditions and surfaces are dry. Application of coating indicates applicator's acceptance of surfaces and conditions.

3.2 PREPARATION

A. Coordination of Work: Review work in which primers are provided to ensure compatibility of the total system for various substrates. Notify Architect of anticipated problems when using materials specified over substrates primed by others.
   1. Pre primed Substrates: Inspect existing conditions in which primers are factory applied to ensure compatibility of the total system for each substrate. Notify Architect of anticipated problems when using the materials specified over factory primed or pre primed substrates.
   2. Existing Painted Surfaces: Inspect previously painted surfaces to ensure compatibility of the existing paints with new paint system for each substrate. Notify Architect of anticipated problems.
   3. Correct defects and clean surfaces affecting bond with paint system. Remove existing paints exhibiting loose surface defects showing signs of rust, scale, or delamination.
   4. Seal marks which may bleed through surface finishes.

B. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified. Provide barrier coats over incompatible primers or remove and reprime. If removal is impractical or impossible because of size or weight of item, provide surface applied protection before surface preparation and painting
   1. Remove hardware and hardware accessories, plates, lighting fixtures, and similar items that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface applied protection before surface preparation and painting. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.
   2. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface applied protection if any.
   3. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
   4. Clean and prepare surfaces to receive paint according to manufacturer's written instructions for each substrate condition and as specified. Provide barrier coats over incompatible primers, existing paint or coating, or remove and reprime.
   5. Correct defects and clean surfaces affecting bond with paint or coating system. Remove existing coatings exhibiting loose surface defects. Seal marks which may bleed through surface finishes.

C. Cleaning: Before applying paint or surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning. Schedule cleaning and painting so dust and contaminants from the cleaning process will not fall on wet, newly painted surfaces.
   1. Remove incompatible primers, including factory applied primers, and reprime substrate with compatible primers or apply barrier coat as necessary to produce desired paint systems indicated.

2. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
3. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.
4. Galvanized Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
5. Aluminum Substrates: Remove surface oxidation.

D. Mildew and Mold Removal: Remove mildew and mold by high power washing (pressure range of 1500 to 4000 psi) with solution of trisodium phosphate and bleach. If substrate is too soft for high power washing, scrub substrate with solution. Rinse with clean water and allow surface to dry.

E. Protective Coverings: Provide protections for duration of the work, including covering furnishings and decorative items. Protect and mask adjacent finishes and components against damage, marking, overpainting, and injury. Clean and repair or replace damage caused by painting.

F. Renovated Surfaces: Clean surface free of loose dirt and dust. Except at gypsum board surfaces, remove existing paint and coatings to bare substrate and prepare substrates to receive new paint system. Test substrate to verify it will bond with primer and receive new paint system without failure. If test fails, clean surface to base substrate and apply barrier coat. Retest to verify surface will accept new paint system.
1. Remove surface film preventing proper adhesion and bond.
2. Wash glossy paint with a solution of sal soda and rinse thoroughly.
3. Remove loose, blistered, and defective paint and varnish; smooth edges with sandpaper.
4. Clean corroded iron and steel surfaces.
5. Repair and blend into portland cement plaster.
6. Prime bare surfaces.
7. Tone varnished surfaces with stain bringing to uniform color.
8. If existing surfaces cannot be put in acceptable condition for finishing by customary cleaning, sanding, and puttying operations, notify Owner and do not proceed until correcting unsatisfactory conditions.

G. Cementitious Substrates: Prepare concrete surfaces to receive paint. Remove efflorescence, chalk, dust, dirt, grease, oils, release agents, mold, mildew, and existing paint. Roughen as necessary to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
1. Use abrasive blast cleaning methods if recommended by paint manufacturer.
2. Do not paint surfaces if moisture content or alkalinity of surfaces exceeds that permitted in manufacturer's written instructions.
    a. Determine alkalinity and moisture content of surfaces by performing appropriate pH testing. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct condition prior to application of paint.
    b. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m).
    c. Relative Humidity Test: Using in situ probes, ASTM F 2170. Proceed with installation after substrates have obtained percent relative humidity level recommended by paint manufacturer.
    d. Perform additional moisture tests when recommended by manufacturer. Proceed with installation when moisture content complies with that permitted in manufacturer's written instructions.
    e. Remove stains caused by weathering of corroding metals with solution of sodium metasilicate after thoroughly wetting with water. Allow to thoroughly dry.

3. Clean concrete floors to receive paint or coating with a 5 percent solution of muriatic acid or etching cleaner. Flush floors with clean water to remove acid; neutralize with ammonia, rinse, allow to dry; vacuum before painting.

H. Ferrous Metals: Clean ungalvanized ferrous metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC recommendations.
1. Blast steel surfaces clean as recommended by paint system manufacturer and according to SSPC-SP 6/NACE No. 3.
2. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
3. Touch up bare areas and shop-applied prime coats that have been damaged. Wire brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as the shop coat.

I. Galvanized Ferrous Metal Substrates: Clean galvanized surfaces with nonpetroleum based solvents leaving surface free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

J. Shop Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop primed surfaces.

K. Aluminum Substrates: Clean surfaces to remove oil, grease, surface oxidation, and contaminants in accordance with SSPC SP-1 Solvent Cleaning. Lightly abrade surface with a nonmetallic pad.

L. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.

M. Plaster/Stucco Substrates: Remove contaminants, release agents, curing compounds, efflorescence, chalk, mold, mildew, and similar deterrents. Spot patch existing plaster to eliminate blisters, buckles, excessive crazing, and to check cracking, dryouts, efflorescence, sweat outs, and similar deflects the prevent plaster from bonding with paint or coatings. Sand or texture repair or patch to match adjacent finish and to remove trowel marks.
1. Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
2. Deep Cracks: Clean out and fill deep cracks with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
3. Do not paint surfaces if moisture content or alkalinity of surfaces exceeds that permitted in manufacturer's written instructions. Test for alkali using litmus paper.
4. Allow patching and repair compounds to set and cure before painting.

N. Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair.

O. Wood Substrates:
1. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
2. Sand surfaces that will be exposed to view, and dust off.
3. Prime, stain, or seal wood to be painted. Prime edges, ends, faces, undersides, and back sides of wood, including cabinets, counters, cases, and paneling.
4. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.

5. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

P. Pipe Covering and Insulation: Clean to remove loose, foreign, and objectionable material before applying sealing coat.

Q. Preparation of Substrates for Wallcovering: Prime and seal substrate with release coat in accordance with wallcovering manufacturer's recommendations for substrate.
1. Assure compatibility with product of wall covering manufacturer.
2. Fill indentations in substrate and prime with opaque white primer before applying release coat.
3. Apply release coat in accordance with manufacturer's recommendations.

R. Barrier Coat: Provide barrier coats over incompatible primers or remove and reprime. Notify Owner in writing of anticipated problems using specified finish coat material over previously coated substrates.

S. Material Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
3. Do not use thinners for water based paints.
4. Tinting: Tint each undercoat a lighter shade to facilitate identification of each coat where multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

A. Comply with manufacturer’s written instructions and recommendations applicable to substrates and paint systems indicated.
1. The term *exposed surfaces* includes areas visible when permanent or built in fixtures, grilles, convector covers, covers for finned tube radiation, and similar components are in place. Extend coatings in these areas to maintain system integrity and provide desired protection.
2. Use applicators and techniques suited for paint and substrate indicated.
3. Provide finish coats compatible with primers.
4. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
5. Paint exposed surfaces. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces.
    a. Field painting of exposed surfaces include bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory applied final finish.
    b. Areas visible when permanent or built in fixtures, grilles, convector covers, covers for finned tube radiation, and similar components are in place.
    c. Extend coatings in areas, as required, to maintain system integrity and provide desired protection.
6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
7. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.

8. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
9. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
10. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or surface imperfections. Cut in sharp lines and color breaks.
11. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
12. Provide finish coats compatible with primers used.
13. Sand lightly between each succeeding enamel or varnish coat.

B. Items not to Receive Paint: Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

C. Applicators: Apply paints and coatings by brush, roller, spray, or applicators recommended by manufacturer.
1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.
2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool recommended by manufacturer for material and texture required.
3. Spray Equipment: Use airless spray equipment with orifice size recommended by manufacturer for material and texture required.

D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.
1. Measure film thickness on magnetic surfaces by use of Elcometer thickness gauge and on nonmagnetic surfaces by pit gauge or Tooke Gauge.

E. Application: Apply first coat to surfaces that have been cleaned, pretreated, or prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer.
2. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished after removing rust and scale and priming or touching up surface sand if acceptable to topcoat manufacturers.
3. If undercoats, stains, or conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive dry film thickness equivalent to that of flat surfaces.
4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried and cured to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.

F. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and occupied spaces.
1. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

2. Prime and paint uninsulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, heat exchangers, tanks, ductwork, conduit, switchgear, and paintable insulation except where items are prefinished.
3. Paint interior surfaces of air ducts, and convector and baseboard heating cabinets visible through grilles and louvers with one coat of flat black paint, to visible surfaces. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.
4. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.
5. Color code equipment, piping, conduit, and exposed duct work in accordance with requirements indicated. Color band and identify with flow arrows, names, and numbering.
6. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.
7. Concealed Members: Wherever steel and metal parts to receive paint are built into and concealed by construction, paint as specified for exposed parts so finish painting is complete before members are concealed.

G. Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work: Painting is limited to items exposed in equipment rooms and occupied spaces.
1. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
2. Prime and paint uninsulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, heat exchangers, tanks, ductwork, conduit, switchgear, and paintable insulation except where items are prefinished.
3. Paint interior surfaces of air ducts, and convector and baseboard heating cabinets visible through grilles and louvers with one coat of flat black paint, to visible surfaces. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.
4. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.
5. Color code equipment, piping, conduit, and exposed duct work in accordance with requirements indicated. Color band and identify with flow arrows, names, and numbering.
6. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

H. Electrostatic Spray Painting: Apply coating electrostatically to finished surfaces, free from runs, sags, visible overlaps, holidays, craters, pinholes and other defects detrimental to protective and decorative qualities of coating.
1. Thickness of Coatings: 1.5 to 2.0 mils dry film thickness. Measure dry film thickness with magnetic gauge.
2. Use application techniques, equipment, materials, and preparation procedures recommended by manufacturer.

I. Block Fillers: Apply block fillers to concrete masonry block at rate to ensure complete coverage with pores filled.

J. Prime Coats: Before applying finish coats, apply prime coat, recommended by manufacturer, to material required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or defects due to insufficient sealing.

K. Finish Coats: Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance without bleed through.

1. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or surface imperfections is not acceptable.
2. Transparent (Clear) Finishes: Use multiple coats to produce glass smooth surface film of even luster. Provide a finish free of laps, cloudiness, color irregularity, runs, brush marks, orange peel, nail holes, or other surface imperfections. Provide satin finish for final coats.

L. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

M. Touch Up: Touch up marred, scraped, and blemished areas of surfaces which were factory primed or previously coated.
1. Prepare and touch up scratches, abrasions, and blemishes and remove foreign matter before proceeding with succeeding coats.
2. Touch up marred, scraped, and blemished areas of factory primed or previously coated surfaces.
3. Feather touch up coating overlapping minimum 2 inches onto adjacent unblemished areas producing smooth, uniform surface.
4. As soon after erection and installation as possible, touch up fasteners, welded surfaces and surroundings, field connections, and areas on which shop coat has been abraded or damaged with specified primer before corrosion and other damage occurs from exposure.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness (DFT) Testing: Tests for dry film thickness may be determined by using a Tooke Scale and microgroover, an electronic scanner, or the Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. It is of the upmost important to the District that the sites remain in a safe, clean, and well maintained condition. At the end of each day, leave the site ready to use by staff and students. Protect staff and students and the learning environment throughout the work.

B. Cleanup: At the end of each day, remove empty cans, rags, rubbish, and discarded paint materials from site. After completion of painting work, clean glass and paint spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. Provide *Wet Paint* signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work. After related work is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

E. At completion of painting activities, touch up and restore damaged or defaced painted surfaces.

F. Waste Management: Legally dispose of unused paint and paint containers in accordance with manufacturer's recommendations and environmental regulations.

PART 4 - SCHEDULES

A. The following is a schedule of typical painted items and does not specifically include every item that is to receive paint but should establish type and quality of finish for all items normally included in a complete paint job.

B. Exterior Surfaces: Descriptions in schedule apply to new and previously painted surfaces. Number of coats listed is minimum, additional coat may be required to provide suitable uniform finish.
   1. Ferrous Metal (Semi-Gloss Enamel) Completely re-prime all shop primed items in field.
      a. 1st coat: Dunn Edwards Bloc-Rust Primer BRPR00-1 Series.
      b. 2nd and 3rd coats: Dunn Edwards Evershield EVSH50 Semi-Gloss
   2. Metal Deck (underside) and Supporting Structural Steel Members
      a. 1st coat: Dunn Edwards Bloc-rust Primer BRPR00-1 Series.
      b. 2nd and 3rd coats: Dunn Edwards Evershield EVSH50 Semi-Gloss.
   3. Galvanized Metal Railings (Gloss Urethane enamel) Only when previously painted
      a. 1st coat: Metal Clean and Etch SCME-01.
      b. 2nd coat: Dunn Edwards Ultragrip Multisurface Primer UGPR00.
      c. 3rd and 4th coats: Dunn Edwards Evershield EVSH50 Semi-Gloss.
   4. Galvanized Metal Non-Railings (Miscellaneous Galvanized metals, underside of metal decking, flashing, etc.) Semi-Gloss enamel
      a. 1st coat: Metal Clean and Etch SCME-01.
      b. 2nd coat: Dunn Edwards Ultragrip Multisurface Primer UGPR00.
      c. 3rd and 4th coats: Dunn Edwards Evershield EVSH50 Semi-Gloss.
   5. Cement Plaster and Exposed Concrete (Semi-Gloss) Flat only if over 8 feet high.
      a. 1st coat: Dunn Edward Eff-Stop Select ESSL00.
      b. 2nd and 3rd coats: Dunn Edwards Evershield Flat EVSH10.
   6. Wood (Flat if over 8 feet high)
      a. 1st coat: Dunn Edwards E-Z Prime Premium EZPR00.
      b. 2nd and 3rd coats: Dunn Edwards Evershield Flat EVSH10.
   7. Wood (Semi-gloss)
      a. 1st coat: Dunn Edwards E-Z Prime Premium EZPR00.
      b. 2nd and 3rd coats: Dunn Edwards Evershield EVSH50 Semi-Gloss.
   8. Existing Concrete Block (Semi-Gloss) Flat only if over 8 feet high.
      a. 1st coat: Dunn Edwards Eff-Stop Select ESSL00.
      b. 2nd and 3rd coats: Dunn Edwards Evershield EVSH50 Semi-Gloss or Flat EVSH10.
   9. Aluminum In-Fill Panels
      a. 1st coat: Factory Prime coat (Touch up if abraded).
      b. 2nd and 3rd coats: Dunn Edwards Evershield EVSH50 Semi-Gloss
   10. Cementitious Siding (Semi-Gloss) Flat if over 8 feet high.
      a. 1st coat: Dunn Edwards Eff-Stop Select ESSL00.
      b. 2nd and 3rd coat: Dunn Edwards Evershield EVSH50 Semi-Gloss or flat EVSH10.

C. Interior Surfaces: Descriptions in schedule apply to new and previously painted surfaces. Number of coats listed is a minimum, additional coat may be required to provide suitable uniform finish.
   1. New Gypsum Board (Semi-gloss at Walls, Gloss at Kitchen and Restroom Ceilings, and Flat at other ceilings, Enamel).
      a. 1st coat: Dunn Edwards Vinylastic select VNSL00.
      b. 2nd and 3rd coats: Dunn Edwards Evershield EVSH50 Semi-Gloss (for walls) Dunn Edwards Evershield EVSH60 (for gloss ceilings) Dunn Edwards Spartawall flat SWLL10 (for flat ceilings).

2. Existing Gypsum Board (Semi-Gloss at Walls, Floss at Kitchen and Restroom Ceilings, and flat at Ceilings, Enamel).
   a. 1st coat: Dunn Edwards Interkote Premium IKPR00 or B-I-N Primer-Sealer Stain-Killer if necessary.
   b. 2nd and 3rd coats: Dunn Edwards Evershield EVSH50 Semi-gloss (for walls) Dunn Edwards Evershield EVSH60 (for gloss ceilings) Dunn Edwards Spartawall flat SWLL10 (for flat ceilings).
3. New or Existing Painted Wood (Semi-Gloss Enamel)
   a. 1st coat: Dunn Edwards Interkote Premium IKPR00 or B-I-N Primer-Sealer Stain-Killer if necessary.
   b. 2nd and 3rd coats: Dunn Edwards Evershield EVSH50 Semi-Gloss.
4. New Wood to Receive Transparent finis (Stain and Lacquer)
   a. 1st coat: Dunn Edwards Valpro Sanding Sealer NAS 2750.
   b. 2nd and 3rd coats: Dunn Edwards Valpro Satin Lacquer NAF 2752.
5. Existing Stained Wood (Varnish Finish)
   a. 1st coat: Minwax Stain
   b. 2nd and 3rd coats: Defthane Polyurethane Satin Varnish.
6. Existing Stained Wood (Lacquer finish)
   a. 1st coat: Stain to provide uniform finish, match existing tone Valspar Zenith Stain.
   b. 2nd and 3rd coats: Dunn Edwards Valpro Satin lacquer NAF 2752.
7. Ferrous Metal (Semi-Gloss Enamel) – Re-prime all shop primed items in field.
   a. 1st coat: Dunn Edwards BLOC-Rust Premium BRPR00-1 series.
   b. 2nd and 3rd coats: Dunn Edwards Evershield EVSH50 Semi-gloss
   c. Typical paint system at hollow metal doors and frames.
8. Cement Plaster and Exposed Concrete (Semi-Gloss at Walls, Gloss at Kitchen and Restroom Ceilings, and Flat at Ceilings, Enamel).
   a. 1st coat: Dunn Edwards Ultra Grip Premium GPR00 series or B-I-N Primer-Sealer Stain-Killer if necessary.
   b. 2nd and 3rd coats: Dunn Edwards Evershield EVSH50 Semi-gloss (for walls) Dunn Edwards Evershield EVSH60 (for gloss ceilings) Dunn Edwards Spartawall Flat SWLL10 (for flat ceilings).
9. Acoustical Ceiling Tiles (Flat)
   a. 1st coat: Dunn Edwards Ultra Grip Premium UGPR00 series or B-I-N Primer-Sealer Stain-Killer.
   b. 2nd and 3rd coats: Dunn Edwards Acoustikote W615.
10. Galvanized and Zinc Alloy Metal, (Semi-gloss Enamel).
    a. 1st coat: Metal Clean and Etch SCME-01.
    b. 2nd coat: Dunn Edwards Ultra Grip Premium UGPR00 series.
    c. 3rd and 4th coats: Dunn Edwards Evershield EVSH50 Semi-Gloss
11. Concrete Block (Semi-Gloss)
    a. 1st coat: Dunn Edwards Blocfil Select SBSL00.
    b. 2nd and 3rd coats: Dunn Edwards Evershield EVSH50 Semi-Gloss

END OF SECTION 09 90 00

SECTION 09 96 23

ANTI-GRAFFITI COATINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Preparation, materials, services, and equipment required in conjunction with the application of a non-sacrificial anti-graffiti coating for interior/exterior wall surfaces identified on drawings.

1.3 SUBMITTALS

A. Product Data:
   1. Manufacturer's technical literature, specifications, and application instructions for the specified coating material for Architect's approval.
   2. Manufacturer's application instructions.

B. Samples:
   1. Obtain either liquid or drawn down sample(s) of the specified coating for sample application and Architect's color approval. Sample application is covered in this Section. Approved sample will be basis for which all work will be judged.

C. Certifications:
   1. Applicator's certification of qualifications as specified in Paragraph 1.4, A below.
   2. Manufacturer's certification that coating material to be applied is in conformance with federal, state and local environmental Volatile Organic Compounds (VOC) regulations.

1.4 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the Work of this Section with minimum three (3) years experience and approved by manufacturer. Provide a list of five (5) most recently completed projects where the coating material was used. Include the project name, location, architect, and method of application. Applicator shall state the intended use of the proper application equipment and that it has been well maintained.

B. Mock-Up:
   1. Apply coating in accordance with manufacturer's application instructions as directed by the Architect to each substrate material which matches actual job conditions. Determine the best method of application, optimum coverage rate, and number of coats required to produce the desired appearance.
   2. After sample treatment has cured in accordance with manufacturer's recommendations, verify the substrate is coated with sufficient material to produce the desired appearance and color.
   3. Obtain Architect's approval of coverage appearance and color prior to full scale application. Approved sample will be basis for which all work will be judged.

C. Pre-Application Meeting: Convene a pre-application meeting prior to the start of application of the specified material. Attendance shall be a representative of the application firm, the Architect, and the material manufacturer. Notify each of the attendees at least three (3) days prior to the meeting time.

1.5 DELIVERY, STORAGE AND PROTECTION

A. Material Delivery: Deliver materials to the job site in original sealed containers, clearly marked with manufacturer's name, brand name, and type of material and color or color formula. Verify the product matches that of the original sample applied on the mock-up wall.

B. Storage and Protection: Store materials inside if possible, away from sparks and open flame. Store in a secure area to avoid tampering and contamination. Water based materials must be kept from freezing. Store and handle according to manufacturer's written instructions.

1.6 PROJECT CONDITIONS

A. Surface Preparation: Surface must be free of cracks, dirt, oils, paint or other contaminants which may affect the appearance or performance of the coating material.

B. Environmental Requirements:
1. Air and substrate temperature must be above 50 degrees F or below 95 degrees F unless otherwise specified by manufacturer.
2. Do not proceed with application if the substrate is wet or contains frozen water.
3. Do not apply material when rain is predicted within 48 hours; or earlier than five (5) days after the substrate became wet.
4. Do not apply materials in high or gusty winds.

C. Protection:
1. Special precautions should be taken to avoid vapor transmission (fumes) from entering the building being treated. Ventilation systems and fresh air intakes should be turned off and dosed.
2. Protect shrubs, metal, wood trim, glass, asphalt and other building hardware during application from overspray.
3. Do not permit spray mist or liquid to drift onto surrounding properties.

1.7 SCHEDULING

A. Notify Architect not less than 48 hours before each application of coating is scheduled.

1.8 WARRANTY

A. The contractor and applicator shall jointly and severally warrant anti-graffiti coating material against failure in material and workmanship for a period of five (5) years from the date of application.

B. Submit completed manufacturer's written "Request for Warranty Form" to manufacturer ten (10) days prior to application.

C. After completion of the specified material, submit manufacturer's written "5 Year Warranty Application" to manufacturer for processing. Upon receiving validated warranty, submit copies to Architect and Owner.

PART 2 - PRODUCTS

2.1 APPROVED PRODUCT / MANUFACTURER

A. Manufacturer:
1. Vandltop Sacrificial from Rainguard, Dunn Edwards, Los Angeles CA
2. Or Architect Approved Substitute.

B. Basis of Design: Graffiti Melt Coating from Genesis Coatings.

2.2 COATING MATERIAL

A. General: Water Based products shall be 100 percent acrylic. No fillers, extenders, or paraffins.

B. TECHNICAL CHARACTERISTICS:

PROPERTY	RESULT / VALUE	TEST METHOD
Solids Content	28 percent	ASTM D2369
Dry Time	30 minutes *	ASTM D1640
Cure Time	72 to 96 hours *	ASTM D1640
Volatile Organic Content (VOC)	<100 g/L	EPA #24

* Dependent upon weather conditions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify the following:
1. The required joint sealants have been installed.
2. New masonry and mortar has cured a minimum of 21 days.
3. Surface to be treated is clean, dry and contains no frozen water.
4. Environmental conditions are appropriate for application.

3.2 PREPARATION

A. Protection:
1. Special precautions should be taken to avoid vapor transmission (fumes) from entering the building being treated. Ventilation systems and fresh air intakes should be turned off and dosed.
2. Protect shrubs, metal, wood trim, glass, asphalt and building hardware during application from overspray.
3. Do not permit spray mist or liquid to drift onto surrounding properties or parking lots.

3.3 APPLICATION

A. Apply anti-graffiti coating in accordance with manufacturer’s written application instructions.

B. Apply material as supplied by the manufacturer. Do not dilute or thin.

C. Mix material well just prior to application using a power mixer to assure color uniformity.

D. Material must be applied using the proper application equipment, and the same technique used on the mock-up sample panel.

E. Apply treatment evenly until a uniform color and appearance is achieved.

3.4 FIELD QUALITY CONTROL

A. Contact Architect 48 hours prior to application so as to provide observation as required. The Architect or the Architect's representative shall observe the progress as the work proceeds.

B. After coating has cured (minimum of 12 hours), verify color uniformity. Recoat all areas that are unacceptable.

3.5 CLEANING

A. At completion, remove all excess material, debris, and waste resulting from this work from the job site. Dispose of containers in accordance with state and local environmental regulations.

END OF SECTION 09 96 23

SECTION 10 11 00 –TACKBOARD

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: Requirements including but not limited to:
   1. Visual display board assemblies.
   2. Rail support systems for visual display board assemblies.
   3. Modular support systems for visual display board assemblies.
   4. Display rails.
   5. Accessories necessary for a complete installation.

1.3 RELATED SECTIONS

A. Section 06 10 00: Rough Carpentry.

B. Section 09 21 16: Gypsum Board Assemblies.

1.4 SUBMITTALS

A. Product Data: Technical data for each type of product including construction details, material descriptions, dimensions of individual components and profiles, finishes, and accessories for visual display units.
   1. Include electrical characteristics for motorized units.

B. Shop Drawings: Submit plans, elevations, sections, details, and attachment to other work.
   1. Indicate sizes and layout, method of attachment, accessories, trim, details and finish.
   2. Show locations of panel joints. Show locations of field assembled joints for factory fabricated units too large to ship in one piece.
   3. Show locations and layout of special purpose graphics.
   4. Include sections of typical trim members.
   5. Include wiring diagrams for power and control wiring.

C. Samples: Submit for each type of item indicated.
   1. Visual Display Board: Not less than 8-1/2 inches by 11 inches (215 mm by 280 mm), with facing, core, and backing indicated for final work. Include one panel for each type, color, and texture required.
   2. Trim: 6 inch (150 mm) long sections of each trim profile.
   3. Display Rail: 6 inch (150 mm) long section of each type.
   4. Modular Support System: 6 inch (152 mm) long sections.
   5. Accessories: Full size Sample of each type of accessory.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for surface burning characteristics of tackboards.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Surface Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   a. Flame Spread Index: 25 or less.
   b. Smoke Developed Index: 450 or less.
2. 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.
3. Accessibility Requirements: Comply with applicable requirements.
   a. Americans with Disabilities Act of 1990, as amended.
      1) ADA Title II Regulations & the 2010 ADA Standards for Accessible Design.
   b. CBC 2022 California Building Code (CCR Title 24, Part 2, as adopted and amended by DSA).
      1) CBC Chapter 11B, Access to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing.

B. Installer Qualifications: Entity having minimum 5 years documented experience that employs installers and supervisors who are trained and approved by manufacturer.

C. Source Limitations: Obtain each type of visual display unit from single source from single manufacturer.

D. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for fabrication and installation.
1. Build mockup of typical wall area or visual display unit as shown on Drawings and include accessories.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory fabricated visual display units completely assembled in one piece. If dimensions exceed maximum manufactured unit size, or if unit size is impracticable to ship in one piece, provide two or more pieces with joints in locations indicated on approved Shop Drawings.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install visual display units until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. Field Measurements: Verify actual dimensions of construction contiguous with visual display units by field measurements before fabrication.
1. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

1.8 WARRANTY

A. Porcelain Enamel Face Sheets: Written warranty in which Manufacturer agrees to repair or replace porcelain enamel face sheets that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
   a. Surfaces lose original writing and erasing qualities.
   b. Surfaces exhibit crazing, cracking, or flaking.

c. Noticeable deterioration of finish.
d. Writing surface delamination.
e. Fabric discoloration, tearing, or delamination.
f. Unit releasing from substrate.

2. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Natural Cork Sheet: Seamless, single layer, compressed fine grain cork sheet; bulletin board quality; face sanded for natural finish with surface burning characteristics indicated.

B. Plastic Impregnated-Cork Sheet: Seamless, homogeneous, self-sealing sheet consisting of granulated cork, linseed oil, resin binders, and dry pigments that are mixed and calendared onto fabric backing; with washable vinyl finish and integral color throughout with surface-burning characteristics indicated.

C. Vinyl Fabric: Mildew resistant, washable, complying with FS CCC-W-408D, Type II, burlap weave; weighing not less than 21 oz./sq. yd. (712 g/sq. m); with surface burning characteristics indicated.

D. Polyester Fabric: Non-directional weave, 100 percent polyester; weighing not less than 15 oz./sq. yd. (508 g/sq. m); with surface-burning characteristics indicated.

E. Hardboard: ANSI A135.4, tempered.

F. Particleboard: ANSI A208.1, Grade M-1.

G. Medium Density Fiberboard: ANSI A208.2, Grade 130.

H. Fiberboard: ASTM C 208 cellulosic fiber insulating board.

I. Extruded Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6063.

J. Adhesives for Field Application: Mildew-resistant, non-staining adhesive for use with specific type of panels, sheets, or assemblies; and for substrate application; as recommended in writing by visual display unit manufacturer.

K. Primer/Sealer: Mildew resistant primer/sealer recommended in writing by visual display unit manufacturer for intended substrate.

2.2 VISUAL DISPLAY BOARD ASSEMBLY

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Claridge Products and Equipment, Inc.
2. Platinum Visual Systems.
3. ADP Lemco.
4. Koroseal (Tackboards ONLY)
5. ABC School Equipment, Inc.
6. Architectural School Products Ltd.

B. Visual Display Board Assembly: Field or factory fabricated.
1. Assembly: Markerboard and tackboard.
2. Corners: Square.

3. Width: Indicated on Drawings.
4. Height: Indicated on Drawings.
5. Mounting Method: Direct to wall with concealed mounting angle and screws.
6. Basis of Design: Claridge, 800 Series.

C. Markerboard Panel: Porcelain enamel steel (magnetic) writing surface on wood fiber core.
1. Edge: Aluminum frame, integral with tackboard where adjacent.
2. Color: White, Low Gloss

D. Tackboard Panel: Vinyl fabric faced tackboard panel on core indicated.
1. Fabric Wrapped Edge: Wrap edge of tackboard panel with fabric facing.
2. Color and Pattern: Selected by Architect.

E. Aluminum Frames: Fabricated from not less than 0.062 inch (1.57 mm) thick, extruded aluminum; slim size and standard shape of size and shape indicated on Drawings.
1. Field Applied Trim: Snap on trim with no visible screws or exposed joints
2. Aluminum Finish: Clear anodic finish.
3. Color and Pattern: Selected by Architect.

F. Vinyl Trim: Selected by Architect.

G. Joints: Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board as indicated on approved Shop Drawings.

H. Combination Assemblies: Provide hidden spline between abutting sections of visual display panels.

I. Chalk-tray: Continuous.
1. Box Type: Extruded aluminum with slanted front, grooved tray, and cast aluminum end closures.
2. Solid Type: Extruded aluminum with ribbed section and smoothly curved exposed ends.

J. Display Rail: Extruded aluminum display rail with plastic impregnated cork insert, end stops, and continuous paper holder, designed to hold accessories.
1. Size: 2 inches (50 mm) high by length indicated on Drawings.
2. Map Hooks and Clips: One map hook with flexible metal clips every 24 inches (600 mm) of display rail or fraction thereof.
3. Flag Holder: One for each room.
4. Tackboard Insert Color: Selected by Architect.
5. Aluminum Color: Match finish of visual display assembly trim.

K. Paper Holder Display Rail: Extruded aluminum; designed to hold paper by clamping action.

L. Special Purpose Graphics: Fuse or paint semi-visible writing guidelines, penmanship lines, music staff lines, grid, 1 inch (25 mm) square, rectangular graph coordinates, [polar graph coordinates] [horizontal lines, 2 inches (50 mm) o.c., graphic onto surface of porcelain enamel visual display unit. (Only as and where requested and exact location to be determined by District).

2.3 FINISH REQUIREMENTS

A. Comply with NAAMM *Metal Finishes Manual for Architectural and Metal Products* for recommendations for applying and designating finishes.

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

C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Aluminum Finishes:
1. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.
2. Color Anodic Finish: AAMA 611, AA-M12C22A32/A34, Class II, 0.010 mm or thicker.
3. Baked Enamel or Powder Coat Finish: AAMA 2603, except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the work.

B. Examine walls and partitions for proper preparation and backing for visual display units.

C. Proceed with installation after correcting unsatisfactory conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation. Clean substrates of substances, such as dirt, mold, and mildew, that impair the performance of and affect the smooth, finished surfaces of visual display boards.

B. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display units and wall surfaces.
1. Moisture Content: Maximum of 4 percent when tested with an electronic moisture meter.

C. Prime wall surfaces indicated to receive visual display units, direct applied visual display assemblies and as recommended in writing by primer/sealer manufacturer and visual display unit manufacturer.

3.3 INSTALLATION

A. Install visual display surfaces in locations and at mounting heights indicated on Drawings. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

B. Field Assembled Visual Display Board Assemblies: Coordinate field assembled units with grounds, trim, and accessories indicated. Join parts with a neat, precision fit.
1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as acceptable to Architect.
2. Where size of visual display board assemblies or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated or as selected by Architect from manufacturer's standard structural support accessories to suit conditions indicated.

3. Field Applied Aluminum Trim: Attach trim over edges of visual display boards and conceal grounds and clips. Attach trim to boards with fasteners at maximum 24 inches (610 mm) o.c.

C. Factory Fabricated Visual Display Board Assemblies: Adhere to wall surfaces with egg size adhesive gobs at 16 inches (400 mm) o.c., horizontally and vertically.
1. Field Applied Aluminum Trim: Attach trim over edges of visual display boards and conceal grounds and clips. Attach trim to boards with fasteners at maximum 24 inches (610 mm) o.c.
2. Mounting: Height Install visual display units at mounting heights indicated on Drawings, or if not indicated, at heights indicated.
   a. Mounting Height for Grades K through 3: 24 inches (610 mm) above finished floor to top of chalk-tray.
   b. Mounting Height for Grades 4 through 6: 28 inches (711 mm) above finished floor to top of chalk-tray.
   c. Mounting Height for Grades 7 and Higher: 36 inches (914 mm) above finished floor to top of chalk-tray.

D. Factory Fabricated Visual Display Board Assemblies: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display board assemblies with fasteners at not more than 16 inches (400 mm) o.c. Secure tops and bottoms of boards to walls.
1. Field Applied Aluminum Trim: Attach trim over edges of visual display boards and conceal grounds and clips. Attach trim to boards with fasteners at maximum 24 inches (610 mm) o.c.
2. Mounting Height: Install visual display units at mounting heights indicated on Drawings, or if not indicated, at heights indicated.
   a. Mounting Height for Grades K through 3: 24 inches (610 mm) above finished floor to top of chalk-tray.
   b. Mounting Height for Grades 4 through 6: 28 inches (711 mm) above finished floor to top of chalk-tray.
   c. Mounting Height for Grades 7 and Higher: 36 inches (914 mm) above finished floor to top of chalk-tray.

E. Display Rails: Install rails at mounting heights indicated on Drawings, or if not indicated, at height indicated below. Attach to wall surface with fasteners at not more than 16 inches (400 mm) o.c.
1. Mounting Height: 72 inches (1829 mm) above finished floor to top of rail.

F. Tackboard Panels: Attach panels to wall surface with egg size adhesive gobs at 16 inches (400 mm) o.c., horizontally and vertically.
1. Install wrapped edge panels with butt joints between adjacent wall panels.
2. Join adjacent panels with exposed, H shaped aluminum trim covered with same fabric as wall panels.

G. Rail Support System: Install horizontal support rail at mounting heights indicated on Drawings. Attach to wall with fasteners at 12 inches (300 mm) o.c.
1. Mounting Height: 72 inches (1829 mm) above finished floor to top of rail.
2. Hang visual display units on rail support system.

H. Modular Support System: Install adjustable standards at mounting heights indicated on Drawings. Install standards at 48 inches (1200 mm) o.c., vertically aligned and plumb, and attached to wall with fasteners at 12 inches (300 mm) o.c.
1. Mounting Height: 12 inches (305 mm) above finished floor to bottom of standard.
2. Install single slotted standard at each end of each run of standards and double slotted standards at intermediate locations.
3. Provide locking screw at top corner of visual display board at each standard.
4. Hang visual display units on modular support system.

3.4 CLEANING AND PROTECTION

A. Clean visual display units according to manufacturer's written instructions. Attach one removable cleaning instructions label to visual display unit in each room.

B. Touch up factory applied finishes to restore damaged or soiled areas.

C. Cover and protect visual display units after installation and cleaning.

END OF SECTION 10 11 00

SECTION 10 14 00 – PLASTIC SIGNAGE

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: Requirements including but not limited to:
   1. Room identification signs.
   2. Restroom signs
   3. Misc. identification signs
   4. Informational signs (not identification signs)
   5. Accessories necessary for a complete installation.

1.3 RELATED SECTIONS

A. Section 05 40 00: Cold-Formed Steel Framing.

B. Sections 08 Series: Doors.

C. Section 09 21 16: Gypsum Board Assemblies.

D. Section 09 24 00: Cement Plastering.

E. Section 09 30 00: Tiling.

F. Section 10 28 13: Toilet Accessories.

1.4 SUBMITTALS

A. Product Data: Technical data for each type of signage.

B. Shop Drawings: Submit fabrication and installation details and attachments to other work.
   1. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
   2. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.
   3. Diagrams of each type and size of sign.

C. Samples: Submit one sample of each specified sign type, full-sized.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. CBC 2022 California Building Code (CCR Title 24, Part 2, as adopted and amended by DSA).

1) CBC Chapter 11B, Access to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing.
2) CBC Section 11B-703.2 to 703.8. Signage.

2. CFC – 2016 California Fire Code.
3. California Code of Regulations (CCR)
   a. CCR 19-3 - Title 19, Chapter 3.
4. Fed.Stnd - Federal Standard
   a. Fed.Stnd 595C, Colors Used in Federal Procurement.

B. Thermal Movements: For exterior fabricated channel dimensional characters, allow for thermal movements from ambient and surface temperature changes.
   1. Temperature Change: 120 degrees F (67 degrees C), ambient; 180 degrees F (100 degrees C), material surfaces.

1.6 FIELD CONDITIONS

A. Field Measurements: Verify locations of anchorage devices and electrical service embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

B. Lettering: Protect Architectural from public, including but not limited to, students.

1.7 WARRANTY

A. Written warranty signed by manufacturer in which manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Deterioration of finishes beyond normal weathering.
      b. Deterioration of embedded graphic image.
      c. Separation or delamination of sheet materials and components.

   2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. A Good Sign.
   2. ASI Modulex, Inc.
   3. Gemini.
   4. Mohawk Sign Systems.
   5. Vomar Products, Inc.
   6. Western Highway Products.
   7. Or approved equal.

B. Aluminum Castings: ASTM B 26/B 26M, alloy and temper recommended by sign manufacturer for casting process used and for type of use and finish indicated.

C. Aluminum Sheet and Plate: ASTM B 209 (ASTM B 209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

D. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

E. Acrylic Sheet: ASTM D 4802, category standard with manufacturer for each sign, Type UVF (UV filtering).

F. Plastic Laminate Sheet: NEMA LD 3, general purpose HGS grade, 0.048-inch (1.2-mm) nominal thickness.

G. Vinyl Film: UV resistant vinyl film of nominal thickness indicated, with pressure sensitive, permanent adhesive on back; die cut to form characters or images indicated and suitable for exterior applications.

H. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

I. Accessories:
1. Fasteners and Anchors: As necessary for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:
a. Use concealed fasteners and anchors unless indicated to be exposed.
Exposed Metal Fastener Components: Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
2. Adhesive: Recommended by sign manufacturer.
3. Bituminous Paint: Cold applied asphalt emulsion complying with ASTM D 1187.

2.2 SIGNAGE

A. Solid Plastic Tactile Room, Restroom and Miscellaneous Identification Signs: 1/4-inch thick, Graphic Process Sand Carved with pre-drilled holes for mounting screws.
1. Sign Panel Perimeter:
a. Edge Condition: Square cut.
b. Corner Condition in Elevation: 1/4” radius.

2. Mounting at Walls: Stainless steel vandal-proof pin-in-head torx screws
3. Mounting at Glazing: Clear silicone adhesive
4. Text and Typeface: Accessible raised characters and Braille. Finish raised characters to contrast with background color, and finish Braille to match background color.
a. Raised Characters: Refer to drawings.
b. California Contracted Grade 2 Braille: Refer to drawings.
c. Pictograms: Field height of minimum 6 inches; no characters or braille in pictogram field; nonglare, field contrast to pictogram, text descriptors below pictogram field.
d. Accessibility Symbols: Where used, symbols shall comply with CBC 11B-703.7.
5. Color: As selected by Architect from manufacture’s full range of standard colors.
6. For exterior uses, fabricate signs from exterior grade materials with UV inhibitor.
7. Sign Types:
a. Office and Classroom
1) Basis of Design: Mohawk M-310-A; M-310-B
b. Rooms with permanent room name and no room number (i.e. “storage”, “custodian”, “electrical”, etc.)
1) Basis of Design: Mohawk M-1000
2) Size: 4” x 10”
c. Restroom Signs: Refer to drawings.

2.3 FABRICATION

A. Provide sign assemblies according to requirements indicated.
1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies as necessary for shipping and handling limitations. Clearly mark

units for reassembly and installation; apply markings in locations concealed from view after final assembly.

2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners.

2.4 FINISH REQUIREMENTS

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

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

D. Aluminum Finishes:
1. Clear Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.
2. Baked Enamel or Powder Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of signage work. Verify sign support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

B. Proceed with installation after correcting unsatisfactory conditions.

3.2 INSTALLATION

A. Install signs using mounting methods indicated and according to manufacturer's written instructions.
1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Install signs so they do not protrude or obstruct according to the accessibility standard.
3. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches (75 mm) of sign without encountering protruding objects or standing within swing of door.
   a. See drawings for the mounting height and location of each sign.

4. Before installation, verify sign surfaces are clean and free of materials or debris that impair installation.
5. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Mounting Methods:
   1. Exposed Fastener: Install vandal-resistant fastener; set screw head flush with sign face

C. Signs Mounted on Glass: Provide 1/8 inch thick solid plastic sign blank matching sign material, finish, and size onto opposite side of glass to conceal back of sign.

D. 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.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 10 14 00

SECTION 10 28 13 - TOILET ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes: Requirements including but not limited to:
   1. Public use washroom accessories.
   2. Public use shower room accessories.
   3. Private use bathroom accessories.
   4. Electric hand dryers.
   5. Under-lavatory guards.
   6. Custodial accessories.
   7. Accessories necessary for a complete installation.

1.3 SUBMITTALS

A. Product Data: Technical Data including construction details, material descriptions, dimensions of individual components and profiles, and finishes.
   1. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
   2. Include electrical characteristics.

B. Samples: Full size, for each exposed product and for each finish specified.
   1. Approved full size Samples will be returned and may be used in the Work.

C. Product Schedule: Show types, quantities, sizes, and installation locations by room of each accessory required. Identify locations using room designations indicated.

D. Maintenance Data: Submit for inclusion in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Accessibility Requirements: Comply with applicable requirements.
   1. CBC 2022 California Building Code (CCR Title 24, Part 2, as adopted and amended by DSA).
      a) CBC Chapter 11B, Access to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing.

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.

C. Source Limitations: Obtain products from single source from single manufacturer.

1.5 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.

1.6 WARRANTY

A. Mirrors: Written warranty signed by manufacturer in which manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, visible silver spoilage defects.
   2. Warranty Period: 15 years from date of Substantial Completion.

B. Electric Hand Dryers: Written warranty signed by manufacturer in which manufacturer agrees to repair or replace hand dryers that fail within specified warranty period.
   1. Failures include, motors and/or sensors which fail to activate when properly energized.
   2. Warranty Period: 5 years from date of substantial completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Manufacturers: Toilet accessories schedule is based on Bobrick Washroom Equipment. Subject to compliance with requirements, provide products by one of the following:
   1. Bobrick Washroom Equipment, Inc.
   2. Bradley Corporation.
   3. Or approved equal.

B. Stainless Steel: ASTM A 666, Type 304, 0.031-inch (0.8-mm) minimum nominal thickness unless otherwise indicated.

C. Brass: ASTM B 19, flat products; ASTM B 16/B 16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.

D. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch (0.9-mm) minimum nominal thickness.

E. Galvanized Steel Sheet: ASTM A 653/A 653M, with G60 (Z180) hot dip zinc coating.

F. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot dip galvanized after fabrication.

G. 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.

H. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear glass mirrors, nominal 6.0 mm thick.

2.2 COMPONENTS

A. Under-lavatory Guard: Insulating pipe covering for supply and drain piping assemblies that prevent direct contact with piping and/or burns from piping; allow service access without removing coverings.
   1. Product: Truebro LavShield Protective Lavatory Enclosure

2. Material and Finish: Antimicrobial, molded plastic, white.
3. Provide at all lavatories

2.3 FABRICATION

A. 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

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items. Remove temporary labels and protective coatings. Clean and polish exposed surfaces according to manufacturer's written recommendations.

PART 4 - SCHEDULE

4.1 ACCESSORY SCHEDULE

A. TA-1 - Soap Dispensers (OFCI):
1. Mounting: Surface.
2. Model No.: DEB ProLine #98123.
3. Locations: Refer to drawings.

B. TA-2 - Mirrors:
1. Mounting: Surface.
2. Model No.: B-290 at staff toilet rooms; B-1556 at student toilet rooms.
3. Size: 24 inches by 36 inches (600 mm by 900 mm), unless shown otherwise.
4. Locations: Refer to drawings.

C. TA-3 - Toilet Paper Dispensers (At Typical Non-accessible Toilet Stalls) (OFCI):
1. Mounting: Surface.
2. Manufacturer: GP Pro.
3. Model No.: SofPull 56501.
4. Locations: Non-accessible water closets and toilet stalls.

D. TA-4 - Paper Towel Dispensers: (Low Profile)
1. Mounting: Surface (Less than 4” projection)
2. Model No.: B-262.
3. Locations: Staff toilet rooms.

E. TA-5 - Grab Bars: Grab Bars: (At Typical Semi-ambulatory Toilet Stalls)
1. Size/Finish: 36” & 42” x 1-1/2 inch diameter satin stainless steel
2. Clearance: 1-1/2 inch between rail and wall.
3. Model No.: B-6806-42 & B-6806-36
4. Mounting: Attach with concealed mounting kit. Mount parallel to floor.
5. Location: Semi-ambulatory toilet stalls.

F. TA-6 - Sanitary Napkin Dispensers:
1. Mounting: Semi-Recessed.
2. Model No.: B-3706.
3. Operation: Single coin / Double coin - (25/50 cents).
4. Capacity: 20 Napkins/ 30 Tampons.
5. Locations: Indicated on Drawings.

G. TA-7 - Sanitary Napkin Disposal:
1. Mounting: Surface.
2. Model No.: Waxie #820750.
3. Locations: Women’s non-accessible toilet stalls.

H. TA-8 Mop and Broom Holder:
1. Mounting: Surface.
2. Model No.: B-239 x 34.
3. Capacity: Four hooks, three mop holders.
4. Locations: Mop sink at each custodial rooms.

I. TA-9 - Grab Bars: (At Accessible Shower)
1. Mounting: Surface.
2. Model: B-6861 modified (24 x 16).
3. Locations: Accessible shower stalls.

J. TA-10 - Folding Benches: Adult Height:
1. Mounting: Surface, reversible.
2. Models: B-5181.
3. Locations: Accessible shower stalls.

K. TA-11 - Clothes Hook:
1. Mounting: Surface.
2. Model No.: B-6717.
3. Locations: All shower locations.
4. Toilet and Shower Partitions: If toilet and shower partitions are utilized, hooks are to be provided by the partition manufacturer(s) as part of their hardware package.

L. TA-12 - Shower Curtains, Rods and Hooks:
1. Rods: B-047 (36 inches or as indicated).
2. Curtains: B-204-2 (42 inches x 72 inches or as required).
3. Hooks: B-204-1.
4. Mounting/Locations: Accessible shower stalls.

M. TA-13 - Electric Hand Dryers:
1. Mounting: Semi-recessed, maximum 3-9/16 inch recess.
2. Model No.: World Dryer, Slim Dri #L-974 (Optional: XLERATOReco Hand Dryer).
3. Voltage: 120 volt, single phase.
4. Set “Heating Control” to “Off”.
5. Location: Refer to drawings.

N. TA-14 - Recessed Paper Towel Dispenser and Waste Receptacle
   1. Size/Finish: 28” x 14” x 3-15/16” (recess)
   2. Model No.: B-369
   3. Mounting: Provide framed rough wall opening 12-5/8” wide x 26-5/8” high.
   4. Minimum recessed depth required to finish face of wall is 4”
   5. Location: Refer to drawings.

O. TA-15 - Grab Bars: (At Typical Semi-ambulatory Toilet Stalls)
   1. Size/Finish: 42” x 1-1/2 inch diameter satin stainless steel
   2. Clearance: 1-1/2 inch between rail and wall.
   3. Model No.: B-6806-42.
   4. Mounting: Attach with concealed mounting kit. Mount parallel to floor.
   5. Location: Semi-ambulatory toilet stalls.

P. TA-17 - Trash Receptacle
   1. Mounting: Recessed
   2. Model No.: B3644.
   3. Locations: Refer to drawings.

Q. TA-18 - Toilet Paper Dispensers:
   1. Mounting: Semi-recessed (Less than 4” projection).
   2. Model No.: B-3888.
   3. Location: Accessible water closets and toilet stalls.

R. TA-19 - Seat Cover Dispenser:
   1. Mounting: Surface.
   2. Model No.: B-221
   3. Location: All water closets and toilet stalls.

S. TA-20 - Sanitary Napkin Disposal:
   1. Mounting: Recessed.
   2. Model No.: Waxie #820750.
   3. Locations: Women’s accessible toilet stalls.

T. TA-21 – Grab Bars: (At Drinking Fountains)
   1. Style/finish: 1-1/2 inch diameter satin stainless steel.
   2. Model No: Bobrick 819298.
   3. Mounting: Attached with concealed mounting kit.
   4. Location: Drinking fountains without alcove.

U. TA-22 – Paper Towel Dispensers:
   1. Mounting: Surface
   2. Model No.: B-263
   3. Location: Kitchen Toilet Room

V. TA-23 – Trash Receptacle:
   1. Mounting: Surface
   2. Model No.: B-277
   3. Location: Kitchen Toilet Room

SECTION 10 44 00 - FIRE EXTINGUISHERS AND CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes: Requirements including but not limited to:
   1. Fire extinguisher.
   2. Extinguisher cabinet.
   3. Brackets.
   4. Accessories necessary for a complete installation.

1.3 SUBMITTALS

A. Product Data: Submit product data including construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire protection specialties.
   1. Fire Extinguishers: Include rating and classification.
   2. Cabinets: Include roughing in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, panel style.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10 *Standard for Portable Fire Extinguishers*.
   2. Fire Extinguisher Listing: UL listed with UL Listing Mark for type, rating, and classification of extinguisher.
   3. Accessibility Requirements: Comply with applicable requirements.
      a. Americans with Disabilities Act of 1990, as amended.
         1) ADA Title II Regulations & the 2010 ADA Standards for Accessible Design.
      b. CBC 2022 California Building Code (CCR Title 24, Part 2, as adopted and amended by DSA).
         1) CBC Chapter 11B, Access to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing.
         2) CBC section 11B-307, 11B-308, 11B-309 and 11B-403.

B. Source Limitations: Obtain fire extinguishers and fire protection cabinets through one source from a single manufacturer.

1.5 COORDINATION

A. Coordinate size of fire extinguisher cabinets to ensure that type and capacity of fire extinguishers indicated and required by the Fire Marshall are accommodated.

1.6 WARRANTY

A. Warranty: Written warranty in which manufacturer agrees to repair or replace components of portable fire extinguishers failing in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Failure of hydrostatic test according to NFPA 10.
   b. Faulty operation of valves or release levers.
2. Warranty Period: 6 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Basis of Design: Specifications are based on the Potter Roemer Alta Series fire extinguisher cabinets. Subject to compliance with requirements, provide comparable products by one of the following:
   1. J. L. Industries, Inc.
   2. Larsen's Manufacturing Company.
   3. Potter Roemer LLC.

2.2 COMPONENTS

A. Fire Extinguisher: Provide fire extinguishers for each fire extinguisher cabinet and at locations indicated. Provide multipurpose dry chemical units, ULI rated 4-A:20-B:C, 10 lb (4.5-kg) nominal capacity, in enameled steel container. Provide mounting brackets where necessary.

B. Cabinets: Fire rated cabinet sized for housing fire extinguishers of types and capacities indicated or required by AHJ.
   1. Cabinet Construction: Construct fire rated cabinets with double walls fabricated from 1.1mm thick, cold rolled steel sheet lined with minimum 16 mm thick, fire barrier material. Provide factory drilled mounting holes.
      a. Cabinet Metal: Steel sheet.
      b. Cabinet Mounting: Semi-recessed.
      c. Cabinet Trim Style: Semi-recessed.
      d. Cabinet Trim Material: Steel sheet.
      e. Color: White
      f. Door Material: Tempered glass
      g. Door Style: Duo vertical door panel with lock. Vertical red lettering to read: “Fire Extinguisher”.
      h. Door Construction: Fabri NOT USED aterials indicated and coordinated with cabinet types and trim styles selected.
      i. Door Hardware: Door operating hardware of proper type for cabinet type, trim style, and door material and style indicated. Provide projecting lever handle with cam action latch with lock. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.

   2. Semi-recessed Cabinet: Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semirecessed cabinet installation. Square edge trim, 32 mm to 38 mm backbend depth. Cabinet shall have a 4” max projection from the face of wall.

C. Accessories:
   1. Mounting Bracket: Steel, designed to secure fire extinguisher to fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked enamel finish.

2.3 FABRICATION

A. Fire Protection Cabinets: Standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Weld joints and grind smooth. Provide factory drilled mounting holes. Prepare doors and frames to receive locks.

B. Cabinet Doors: Fabricate doors from materials indicated and coordinated with cabinet types and trim styles selected.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 FINISH

A. Apply finishes in factory after products are assembled. Protect cabinets with plastic or paper covering, prior to shipment.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare recesses for recessed fire protection cabinets as required by type and size of cabinet and trim style.

3.2 INSTALLATION

A. Comply with manufacturer's printed instructions for installation.

B. Install fire protection specialties in locations and at mounting heights indicated compliant with accessibility requirements acceptable to authorities having jurisdiction. Fasten cabinets to structure, square and plumb.

C. Fire Protection Cabinets:
   1. Unless otherwise indicated, provide semi-recessed fire protection cabinets.
   2. Fasten mounting brackets to inside surface of fire protection cabinets, square and plumb.

3.3 ADJUSTING AND CLEANING

A. Adjust cabinet doors to operate freely without binding.

B. Examine fire extinguishers for proper charging and tagging. Remove and replace damaged, defective, or undercharged units.

C. On completion of fire protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace fire protection cabinets that cannot be restored to factory finished appearance. Use materials and procedures recommended or furnished by fire protection cabinet and mounting bracket manufacturers.

E. Replace fire protection cabinets damaged or deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 10 44 00

SECTION 12 35 50 - EDUCATIONAL CASEWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SECTION INCLUDES

A. Manufactured plastic laminated casework, hardware and related accessories.

1.3 REFERENCES

A. American National Standards Institute:
   1. ANSI A156.9 - Cabinet Hardware.
   2. ANSI A161.1 - Woodwork Testing Standards
   3. ANSI A208.1 - Mat-Formed Wood Particleboard.

B. Architectural Woodwork Institute:
   1. AWI - Quality Standards Illustrated.

C. National Electrical Manufacturers Association:
   1. NEMA LD 3 - High Pressure Decorative Laminates.

1.4 DEFINITIONS

A. Identification of casework components and related products by surface visibility.
   1. Balanced construction: High pressure laminate or cabinet liner shall be installed on both sides of core to restrict warpage in accordance with AWI Quality Standards Illustrated Section 400B-T-2.
   2. Open Interiors: Open unit without solid door and drawer fronts, and units with full glass insert or acrylic doors.
   3. Closed Interiors: Closed unit behind solid door, drawer fronts, and sliding solid doors.
   4. Exposed Ends: Exterior side surface that is visible after installation.
   5. Other Exposed Surfaces: Faces of doors and drawers when closed and tops of cabinets less than 72 inches above finished floor.
   6. Semi-Exposed Surfaces: Interior surfaces which are visible, bottoms of wall cabinets and tops of cabinets 72 inches or more above finished floor.
   7. Concealed Surfaces: Any surface not visible after installation.

B. Comparable Product: Product demonstrated and approved through submittal process, or where indicated as a produce substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

1.5 PERFORMANCE REQUIREMENTS

A. Unless otherwise indicated, perform work in accordance with AWI “Quality Standards Illustrated”, Custom Grade, except where specification exceeds those standards, the more stringent shall govern.

B. Submit certified product test data in accordance with ANSI A161.1, NEMA LD3, and general static load testing performed and certified by an independent testing agency, covering the following areas of product performance, with these minimum results:
   1. Base cabinet construction/racking test: 800 lbs.
   2. Cabinet front joint loading test: 425 lbs.
   3. Wall cabinet static load test: 2,000 lbs.
   4. Drawer front joint loading test: 600 lbs.
   5. Drawer construction/static load test: 750 lbs.
   6. Cabinet adjustable shelf support device/static load test: 300 lbs.

C. Shelf Loading: Comply with loading/deflection standards of the Composite Panel Association.

D. Comply with CBC 803 & 806 – Class A = Flame spread index 0-25; smoke-developed index 0-450.

1.6 SUBMITTALS

A. Product Data:
   1. Manufacturer's specifications and other data needed to prove compliance with specified requirements.
   2. Manufacturer’s preprinted product information for all hardware proposed on the project.
   3. Manufacturer’s preprinted maintenance instructions for the casework hardware.

B. Shop Drawings:
   1. Indicate size, material and finish.
   2. Show locations and installation procedures, including hardware, sinks, service fixtures, trim and other pertinent data for each unit.

C. Test Data: Certified product test data in accordance with ANSI A161.1, NEMA LD3, and general static load testing performed and certified by an independent testing agency, covering the areas of product performance, as described below.

D. Certification: Provide AWI Quality Certification Program certification for casework fabrication indicating manufacturer’s registration with AWI Quality Certification Program.

E. Samples: Two (2) each, 6 inch by 6 inch by 3/4 inch sample of specified medium density fiberboard core with grade stamp for use as verification of installed product.

1.7 QUALITY ASSURANCE

A. Manufacturer: Minimum of five (5) years’ experience in providing manufactured casework systems for similar types of projects, produce evidence of financial stability, bonding capacity, and adequate facilities and personnel required to perform on this project.

B. Manufacturer: Products certified as meeting or exceeding ANSI-A 161.1 testing standards.

C. Delivery conference: 48 hours prior to delivery, notify Architect of delivery date and time. At the Architect’s discretion, a representative of the Architect may be present at the time of delivery. Casework not conforming to the specified requirements, as reasonably determined by the Architect’s representative, shall be removed and returned to manufacturer for repair or replacement at no additional cost to the Owner or increase in time.

1.8 PRE-INSTALLATION CONFERENCE

A. Section 01 31 19 – Project Meetings.

1.9 PRODUCT HANDLING

A. Deliver completed laminate clad casework, countertops and related products only after wet operations in building are completed. Store in ventilated place, protected from the weather, with relative humidity range of 20 to 50 percent.

B. Protect finished surfaces from soiling and damage during handling and installation with a protective covering.

1.10 JOB CONDITIONS

A. Environmental Requirements: Do not install casework until permanent HVAC systems are operating and temperature and humidity have been stabilized for at least one (1) week.
   1. Manufacturer/Supplier shall advise Contractor of temperature and humidity requirements for architectural casework installation areas.
   2. After installation, control temperature and humidity to maintain relative humidity between 25 and 55 percent.

B. Conditions: Do not store or install casework in building until concrete, masonry, and drywall/plaster work is dry.

1.11 COORDINATION

A. Coordinate the Work of this Section with plumbing work specified in Division 22. Coordinate sink opening construction with sinks specified in Division 22.

B. Coordinate location of blocking in walls for installation and support of wall cabinets.

1.12 WARRANTY

A. Warranty the work specified herein for five (5) years against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials and workmanship.

B. Defects shall include, but not be limited to the following:
   1. Rough or difficult operation, or loose or missing parts.
   2. Delamination of surfaces.
   3. Noticeable deterioration of finish.
   4. Warped or misaligned surfaces or telegraphing of subsurface imperfections.

1.13 RELATED SECTIONS

A. Related work specified elsewhere:
   1. Section 06 20 00 FINISH CARPENTRY AND MILLWORK

PART 2 - PRODUCTS

2.1 CASEWORK MANUFACTURERS

A. Catalog numbers shown on drawings are based on Architectural Woodwork Standards. They are shown for reference only to indicated component requirements only. Fabrication of units shall be in accordance with these designations.

B. Products of the following laminate material manufacturers form the Basis for Design and quality intended.
   1. Formica Corporation, Cincinnati, OH.

2. Wilsonart International, Temple, TX.
3. Nevemar Corporation, Odenton, MD.
4. Lamin-art, Schaumburg, IL.
5. Or approved equal.

2.2 MATERIALS

A. Plastic Laminate: High-pressure decorative laminate complying with NEMA LD3, and the following requirements:
   1. Exterior Color Selection Available:
      a. Architect to select from minimum of 250 selections available, including wood grain patterns and solid colors.
      b. Provide 5 different colors available per project.
      c. If laminate has wood grain, direction of grain shall be vertical on door, end panels, fascia panels, and exposed backs; horizontal on drawer faces, aprons, and top rails.
   2. Laminate grades:
      a. Exposed doors, finished end panels, and other vertical surfaces: GP28 (0.028 inch thick nominal)
      b. Horizontal surfaces other than top: GP28 (0.028 inch thick nominal)
      c. Cabinet Liner: CL20 (0.020 inch nominal), white.
      d. Work Surfaces and Countertops: GP50 (0.050 inch thick nominal) with BK20 (0.20 inch thick) backer sheet.
      e. Backsplash: PH42 (0.042 inch nominal) with nominally balanced backer sheet.
   3. Adhesive: PVA water resistant adhesive. Contact adhesives not permitted.
   4. Chemical Resistant Cabinet Surfacing: (all locations of Science Labs and Prep Rooms) Provide WilsonArt Chemsurf or comparable product at all exterior cabinet faces and exposed end panels and shall be used at all Science Labs and Prep Rooms.
   5. Pressure Fused Laminate:
      a. NEMA LD3 VGL, and NEMA LD3 CLS, Melamine resin impregnated, 120 gram PSM minimum, thermofused to core under pressure.
      b. Color:
         1) Closed interiors, underside of wall cabinets: White.
         2) Exposed and Semi-exposed open cabinets: Match exterior.
      c. Provide balanced construction with same thermofused melamine. Unsurfaced coreboard or simple backers not allowed.

B. Core Material:
   1. Hardboard: AHA A135.4.
   2. Medium Density Fiberboard: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde; minimum 48 pcf density except that minimum for screw holding capacity on face shall be 300 pounds; minimum 3/4 inches (19mm) thick, edged and faced as specified.
   3. Plywood: Exterior grade, hardwood faced, any species, with no defects affecting strength or utility. Overlay plywood not permitted.
   4. Cabinet components shall be of the following minimum core thicknesses:
      a. Cabinet backs and drawer body: 1/2 inch medium density fiberboard.
      b. Drawer bottoms: 1/4 inch plywood
      c. Door and drawer face, base, wall, and tall cabinet tops and bottoms, cabinet sides, drawer spreaders, cabinet back rear hang-strips, structural dividers, and exposed cabinet backs: 3/4 inch medium density fiberboard.
      d. Work surfaces and countertops: 1 inch medium density fiberboard, except use plywood core at counters with sinks.

e. Shelves: 3/4 inch plywood for 30 inches long or less, 1 inch thick plywood for more than 30 inches long; 14" deep, unless otherwise noted. Provide vertical dividers for shelves over 36 inches long.
f. Cabinet Toe-Base: Preservative treated 2x solid lumber.

C. Countertops and Backsplashes (Non-Laboratory):
1. Countertops: Provide countertops with PVC edge in as long as practical continuous lengths. Provide field glued splines at joints. No joints closer than 24 inches either side of sink cutout.
2. Backsplash: 4 inch high unless otherwise shown. No joint shall occur at sink openings. Provide backsplash set in full bead of sealant.
3. At exposed countertop end corners, provide 1 inch radius, or similar safety treatment.

D. Countertops and Backsplashes (Laboratory): Refer to section 12 36 53.

E. Sinks: Refer to Division 22. Sizes as shown on drawings. Provide sealant at sink cut-outs.

F. Service Fixtures: Refer to Division 22.

G. Toe Spaces: Leave toe spaces unfinished for installation of resilient base, unless otherwise shown.

H. End Panels and Filler Strips: Match adjacent case-piece.

I. Edging:
1. Provide the following in accordance with "Edging Locations":
a. Flat Edge PVC: 0.020 inch. Solid, high-impact, purified, color-thru, acid resistant, machine-applied with hot melt adhesives.
b. 3 mm PVC: Solid, high-impact, purified, color-thru, acid resistant, pre-lamination primed edging, machine-applied with hot melt adhesives, and machine profiled to 1/8 inch radius.
2. Edging Locations:
a. Cabinet body edge, including door/drawer front spacer rail: Flat Edge PVC, color matched to door/drawer face or as selected.
b. Forward edge of interior body components, interior dividers, shelf, and top edges of drawer body: Flat Edge PVC to match cabinet interior surface color.
c. Door/Drawer-Front edging: 3mm PVC, color matched to standard laminates.

2.3 CABINET HARDWARE

A. All hardware shall meet ANSI A156.9 and shall be subject to approval by the Architect. All keying shall match existing master key system and be approved by the Owner.
1. Acceptable Manufacturers:
a. Accuride
b. Ives
c. Knape & Vogt
d. National
e. Stanley
f. Rockford Process Control, LLC
g. Blum, Inc.

B. Hinges:
1. Heavy duty, five-knuckle 2 3/4 inch institutional type hinge shall meet ANSI/BHMA A156.9 Grade 1 requirements. Mill ground, hospital tip, Teflon coated tight pin

feature with all edges eased. Hinge shall be full wrap around type of tempered steel 0.095 inch thick. Each hinge shall have minimum of 9 screws, #7, 5/8 inch FHMS to assure positive door attachment.

2. One pair per door to 48 inch height. One and one-half pair over 48 inches in height. Hinge shall accommodate 13/16 thick laminated door and allow 270 degree swing.
3. Finish: US26D.
4. Basis of Design: Rockford Process #376

C. Pulls:
1. Wire design, 4 inches, Chrome, US26D finish.
2. Basis of Design: Rockford Process #P604

D. Sliding Door Hardware:
1. Frameless 1/4 inch glass sliding doors: double track rolling door assembly.
2. Framed 13/16 inch thick stile and rail sliding doors: top mounted track with dual roller hangers. Vertical adjustment for accurate alignment.

E. Drawer Slides:
1. Standard Drawers: 3/4 extension, self-closing, white epoxy-coated, lever disconnect, positive in-stop/out-stop, nylon rollers, minimum 100 pound dynamic load rating at full extension.
2. File Drawers: Full extension, 3-part progressive opening slide, precision steel ball bearing, minimum 100 pound dynamic load rating at full extension, zinc plated or epoxy coated at manufacturer's option.
3. Provide body mounted molded rails for hanging file system for legal or letter size as indicated by manufacturer's model number. Cutting or machining of drawer body/face not permitted.
4. Paper Storage Drawers: Full extension, self-closing, white epoxy-coated, lever disconnect, positive in-stop/out-stop, nylon rollers, minimum 150 pound dynamic load rating at full extension.
5. Basis of Design: Blum Tandem 569 H

F. Catches: Provide opening resistance in compliance with the Americans with Disabilities Act.
1. Provide top-mounted magnetic catch for base and wall cabinet door.
2. Provide two at each tall cabinet door. Catch housing shall be molded in White.

G. Adjustable Shelf Supports:
1. Dual-pin design with anti-tip-up shelf restraints for both 3/4 inch and 1 inch shelves.
2. Include keel to retard shelf slide-off, and slot for mechanical attachment of shelf to clip.
3. Load rating shall be minimum 300 pounds each support without failure.

H. Wardrobe Rod: 1 inch diameter plated steel rod, with captive sockets.

I. Coat Hooks: Single and double prong, wall mount - Satin Aluminum.

J. Locks: Five-disk tumbler cam-style with strike. Locks on cabinets in same room keyed alike. Provide two (2) keys per room where doors and drawers are scheduled to receive locks. Cylinder face and keys to be engraved with matching numbers. Dull chrome finish. Lock core shall be removable with a control key, permitting Owner to change lock arrangements without tools.

2.4 SPECIALTY ITEMS

A. Grommets:

1. Size: 2-1/2 inches diameter with “Flip-Top”™ tab in cap.
2. Colors: As selected by Architect from manufacturer’s available colors.
3. Number/Location: Where electrical, telephone, and computer data wiring need to pass through tops whether shown or not.
4. Approved Product/Manufacturer: Model No. EDP3 manufactured by Doug Mockett & Company, Inc., Manhattan Beach, CA; (800) 523-1269, or comparable product.

B. Hanging File Rails to be provided at all File Drawers.

2.5 FABRICATION

A. Fabricate casework, countertops and related products to dimensions, profiles and details shown on drawings. Fabricate casework square, plumb, and true.

B. Detailed Requirements For Cabinet Construction:

1. Toe-Base:
   a. Continuous, ladder type platform with concealed fastening to cabinet bottom, level and secured to floor
   b. Toe-base at exposed cabinet end panels shall be recessed 1/4 inch from face of finished end, for flush installation of finished base material.
   c. No cabinet sides-to-floor will be allowed.

2. Cabinet Top and Bottom:
   a. Solid sub-top shall be furnished for all base and tall cabinets.
   b. At cabinets over 36 inches bottoms and tops shall be mechanically joined by a fixed divider.
   c. Assembly devices shall be concealed on bottom side of wall cabinets.

3. Cabinet Sides:
   a. Doweled, and glued under pressure, or attached with fully concealed interlocking mechanical fasteners to sub-top and bottom.
   b. Drill holes for adjustable shelves 1-1/4 inches on center.

4. Cabinet Backs:
   a. Side bound, captured in grooves, recessed from cabinet rear, and securely fastened at top and bottom.
   b. Hang rails shall be located at rear of cabinet back and fastened to cabinet sides. Provide minimum of two (2) at base, two (2) at wall, and three (3) at tall cabinets as instructed by casework manufacturer.
   c. Provide removable back panels and closure panels for plumbing access at all sink cabinets, and where shown on drawings.

5. Exposed end corner and face frame attachment:
   a. Butt joint, glued and finish nailed; or attached with fully concealed interlocked mechanical fasteners.

6. Door and Drawer Fronts:
   a. Drawer fronts and hinged doors shall overlay the cabinet body. Maintain a maximum 1/8 inch reveal between pairs of doors, between door and drawer front, or between multiple drawer fronts within the cabinet.
   b. Where indicated, provide Stile and Rail doors with full 1/4 inch plate glass, hinged or sliding. Exposed lite-opening edges shall be trimmed and glazed with extruded glazing bead.

c. Where indicated, frameless sliding glass doors shall be 1/4 inch thick plate glass with ground and polished edges. Fit with anodized aluminum shoes and nylon rollers.

C. Drawers:

1. Drawer fronts: apply to separate drawer body component sub-front.
2. Drawer sides: doweled to receive front and back, glued under pressure, machine squared.
3. Drawer bottom: set into front and sides, 1/4 inch deep groove with minimum 3/8 inch standing shoulder, continuously glued. Reinforce drawer bottoms with 1/2 inch by 4 inch front-to-back intermediate underbody stiffeners, mechanically fastened. One at 24 inches, two at 36 inches, and over.
4. Paper storage drawers: fitted with full width hood at back.
5. File Drawers: inside drawer dimensions to accommodate letter and/or legal size hanging file rails.

D. Vertical and Horizontal Dividers: As required by manufacturer for type and style of component.

E. Door/Drawer Front Rail: As required by manufacturer for type and style of component, and hardware placement.

F. ADA, Americans with Disabilities Act Requirements: The following special requirements shall be met, where specifically indicated on architectural plans as “ADA”, or by General Note. Shall be in compliance with Federal Register Volume 56, No. 144, Rules and Regulations:

1. Countertop height: With or without cabinet below, not to exceed a height of 34 inches Above Finished Floor (A.F.F.), at a surface depth of 24 inches
2. Kneespace clearance: minimum 27 inches A.F.F. at apron, and 30 inches clear span width.
3. 12 inch deep shelving, adjustable or fixed: Not to exceed a range from 15 inches A.F.F. minimum to 48 inches A.F.F. maximum.
4. Wardrobe cabinets: Provide with rod/shelf adjustable to 48 inches A.F.F. at a maximum 21 inch shelf depth.
5. Sink cabinet clearances: In addition to above, upper kneespace frontal depth shall be no less than 8 inches, and lower toe frontal depth shall be no less than 11 inches, at a point 9 inches A.F.F.

PART 3 - EXECUTION

3.1 INSPECTION

A. Inspect the installed work of other trades and verity that such work is complete to the point where this installation may properly commence.

B. Verify that casework and equipment may be installed in accordance with the original design, pertinent codes, and regulations, and approved shop drawings.

C. Verify casework and equipment requiring power or other utilities, have power and other utilities ready for their installation.

D. In the event of discrepancy, immediately notify the Architect. Do not proceed with installation in areas of discrepancy until such discrepancies have been resolved.

3.2 INSTALLATION

A. Items of casework shall be uncrated, placed in proper location, assembled, leveled, and secured to wall, base or floor, when required, at locations indicated on the Architect's drawings. Apply and adjust hardware.

B. Plumbing and electrical items not specified in this Section shall be furnished under Division 22 and 26. The casework supplier shall be responsible for all cutouts necessary to receive plumbing items. Provide 'J' clamps to secure sinks to countertops.

C. Installation of work furnished by the various trades shall be coordinated to assure properly functioning equipment at the completion of the job.

D. Verify lengths of countertops, splashes, and bases. All units with exposed backs, interiors, ends and/or bases shall be plastic clad with colors as selected by Architect.

E. Provide backsplashes and end splashes wherever a back or end is next to a wall, where shown or not.

F. Provide matching fillers and scribes to fit cabinets to partitions, equipment, and columns.

G. Provide closure panels at top and bottom of wall hung cabinets at corner intersections.

H. Repair or remove and replace defective work as directed on completion of installation.

I. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

J. Provide necessary protective measures of finished work to prevent damage of casework and equipment from exposure to other construction activity.

END OF SECTION 12 35 50

SECTION 22 00 00 GENERAL PLUMBING PROVISIONS

PART 1 - GENERAL

1.01 GENERAL CONDITIONS:

A. The foregoing General and Special Conditions shall form a part of this Division with the same force and effect as though repeated herein. The provisions of this Section shall apply to all the Sections of Division 22.

1.02 CODES AND REGULATIONS:

A. All work and materials shall be in full accordance with current rules and regulations of applicable codes. Nothing in these drawings or specifications is to be construed to permit work not conforming to these codes. Should the drawings or specifications call for material or methods of construction of a higher quality or standard than required by these codes, the specifications shall govern. Applicable codes and regulations are:

1. California Code of Regulations – CCR:
   a. Title 8, Industrial Relations.
   b. Title 24, Building Standards.
2. California Building Code – CBC.
3. California Mechanical Code – CMC.
4. California Plumbing Code – CPC.
5. California Green Building Code.
6. American Gas Association – AGA.
7. American National Standards Institute – ANSI.
8. American Society of Heating, Refrigerating and Air Conditioning Engineers – ASHRAE.
9. American Society of Mechanical Engineers – ASME.
10. American Society for Testing and Materials – ASTM.
11. American Water Works Association – AWWA.
12. Cast Iron Soil Pipe Institute – CISPI.
13. California Electrical Code – CEC.
14. National Electrical Manufacturers Association – NEMA.
15. National Fire Protection Association – NFPA.
16. National Sanitation Foundation – NSF.
17. Plumbing and Drainage Institute – PDI.
18. Sheet Metal and Air Conditioning Contractors National Association – SMACNA.
19. Underwriters' Laboratory – UL.
20. Occupational Safety and Health Act - OSHA.
21. California Assembly Bill 1953 (AB1953).

1.03 PERMITS AND FEES:

A. The Contractor shall take out all permits and arrange for all tests in connection with his work as required by local ordinances. All charges are to be included in the work. Permits for equipment connected to a particular system are to be considered as a part of the work included under each system; for example, permits for electric motor connection are part of electrical work, permits for domestic water or gas connections are part of plumbing work. All charges for service connections, meters, etc. by utility companies or districts shall be included in the work.

1.04 COORDINATION OF WORK:

A. Layout of materials, equipment and systems is generally diagrammatic unless specifically dimensioned. The actual locations of all materials, piping, fixtures, equipment, supports, etc. shall be carefully planned, prior to installation of any work, to avoid all interference’s with each other, or with structural, electrical or architectural elements. Verify the proper voltage and

phase of all equipment with the electrical plans. All conflicts shall be called to the attention of the Engineer prior to the installation of any work or the ordering of any equipment.

1.05 GUARANTEE:

A. Guarantee shall be in accordance with the General Conditions. These specifications may extend the period of the guarantee for certain items. Where such extensions are called for, or where items are normally provided with guarantee periods in excess of that called for in the General Conditions, the Certificate of Guarantee shall be furnished to the Owner through the Engineer.

1.06 EXAMINATION OF SITE:

A. The Contractor shall examine the site, compare it with plans and specifications, and shall have satisfied himself as to the conditions under which the work is to be performed. No allowance shall subsequently be made in his behalf for any extra expense to which he may be put due to failure or neglect on his part to make such an examination.

1.07 SUBMITTALS:

A. Submit shop drawings in accordance with Division 01.

B. Shop Drawings: Within 30 days of contract award, the Contractor shall submit six copies of shop drawings for all materials, equipment, etc. proposed for use on this project. Material and equipment shall not be ordered or installed until written review is processed by the Engineer. Any item omitted from the submittal shall be provided as specified without substitution. All shop drawings must comply with the following:

1. Shop drawings are required for all material and equipment items and shall include manufacturer's name and catalog numbers, dimensions, capacities, performance curves, and all other characteristics and accessories as listed in the specifications or on the drawings. Descriptive literature shall be current factory brochures and submittal sheets. Capacities shall be certified by the factory.
2. All shop drawings shall be submitted at one time in a neat and orderly fashion in a suitable binder with title sheet including Project, Engineer and Contractor; Table of Contents; and indexed tabs dividing each group of materials or item of equipment. All items shall be marked with the specification paragraph number for which they are proposed. All equipment shall also be identified by the mark number as indicated on the drawings.
3. All capacities, characteristics, and accessories called for in the specifications or on the drawings shall be highlighted, circled or underlined on the shop drawings. Calculations and other detailed data indicating how the item was selected shall be included for items that are not scheduled. Data must be complete enough to permit detailed comparison of every significant characteristic which is specified, scheduled, or detailed.

C. Substitutions: Manufacturers and model numbers listed in the specifications or on the drawings represent the standard of quality and the features desired. Unless otherwise noted, alternate manufacturers may be submitted for review by the Engineer. Calculations and other detailed data indicating how the item was selected shall be included. The Contractor shall assume full responsibility that substituted items or procedures will meet the specifications and job requirements and shall be responsible for the cost of redesign and modifications to the work caused by these items.

D. Review: Submittals will be reviewed for general conformance with the design concept, but this review does not guarantee quantity shown, nor does it supersede the responsibility of the Contractor to provide all materials, equipment and installation in accordance with the drawings and specifications. The Contractor shall agree that shop drawing submittals processed by the

Engineer are not Change Orders; that the purpose of shop drawing submittals by the Contractor is to demonstrate to the Engineer that the Contractor understands the design concept; that he demonstrates his understanding by indicating which equipment and material he intends to furnish and install and by detailing the fabrication and installation methods he intends to use. The Contractor shall agree that if deviations, discrepancies or conflicts between shop drawings and design drawings and specifications are discovered either prior to or after shop drawing submittals are processed by the Engineer, the design drawings and specifications shall control and shall be followed.

1.08 OPERATION AND MAINTENANCE INSTRUCTIONS:

A. Submit one electronic pdf copy for review and after approved submit three hard copies of the Operation and Maintenance Instructions and Wiring Diagrams for all equipment and parts lists for all equipment, etc. shall be submitted to the Engineer. All instructions shall be clearly identified by marking them with the same designation as the equipment item to which they apply (e.g. WH-1). All wiring diagrams shall agree with revised shop drawings and indicate the exact field installation. All instructions shall be submitted at the same time and shall be bound in a suitable binder with tabs dividing each type of equipment (e.g. Water Heaters, Pumps, Motors, etc.). Each binder shall be labeled indicating "Operating and Maintenance Instructions, Project Title, Contractor, Date" and shall have a Table of Contents listing all items included. **(These submittals shall be submitted with regular submittals at start of job so Commissioning Contractor can start on the commissioning check list for LEED Certification or Title 24 Requirements)**

B. Verbal: The Contractor shall verbally instruct the Owner's maintenance staff in the operation and maintenance of all equipment and systems. The controls contractor shall present that portion of the instruction that applies to the control system. The Engineer's office shall be notified 96 hours prior to this meeting.

C. Acknowledgment: The Contractor shall prepare a letter indicating that all operation and maintenance instructions (printed, verbal and posted) have been given to the Owner, to the Owner's satisfaction. This letter shall be acknowledged (signed) by the Owner and submitted to the Engineer.

1.09 RECORD DRAWINGS:

A. The Contractor shall maintain a set of prints for the project as a record of all construction changes made. As the Work progresses, the Contractor shall maintain a record of all deviations in the Work from that indicated on the drawings. Final location of all underground work shall be recorded by depth from finished grade and by offset distance from permanent surface structures, i.e. buildings, curbs and walks. In addition, the water, gas, sewer, etc. within the building shall be recorded by offset distances from building walls. The original drawings will be made available to the Contractor from which he shall have a set of reproducible drawings made. The Contractor shall then transfer the changes, notations, etc. from the marked-up prints to the reproducible drawings. The record drawings (marked-up prints and reproducibles) shall be submitted to the Engineer for review (as an alternative, the marked-up prints may be photocopied full size on reproducible stock).

PART 2 - PRODUCTS

2.01 PROTECTIVE COATING FOR UNDERGROUND PIPING:

A. All ferrous pipe below grade (except cast iron) shall have a factory applied protective coating of extruded high density polyethylene, 35 to 70 mils total thickness, X-Tru Coat, Scotchkote. All fittings and areas of damaged coating shall be covered with two layer double wrap of 10 mil

polyvinyl tape to total thickness of 40 mils. Manville Corporation. Protective coating shall be extended 6" above surrounding grade.

2.02 CONCRETE ANCHORS:

A. Concrete Anchors shall comply with CBC 1901A.3. Steel stud with expansion anchor requiring a drilled hole; powder driven anchors are not acceptable. Minimum concrete embedment shall be 4-1/2 diameters. Minimum spacing shall be 10 diameters center-to-center and 5 diameters from center to edge of concrete. Maximum allowable stresses for tension and shear shall be 80% of the test report values "with special inspection". Anchors shall be Hilti, Philips - or Approved equal.

2.03 SEISMIC RESTRAINTS:

A. All plumbing systems (all equipment, piping, etc.) shall be provided with seismic restraints in accordance with "Guidelines for Seismic Restraint of Mechanical Systems" dated 2006 by SMACNA.

2.04 SYSTEM IDENTIFICATION:

A. Above Grade Piping: Provide markers on piping which is either exposed or concealed in accessible spaces. For piping systems, other than drain and vent lines, indicate the fluid conveyed or its abbreviation, either by preprinted markers or stenciled marking, and include arrows to show the direction of flow. Comply with ANSI A13.1 for colors. Locate markers at ends of lines, near major branches and other interruptions including equipment in the line, where lines pass through floor, walls or ceilings or otherwise pass into inaccessible spaces, and at 50' maximum intervals along exposed portion of lines. Marking of short branches and repetitive branches for equipment connections is not required.

B. Equipment: All equipment shall be identified with a plastic laminated, engraved nameplate which bears the unit mark number as indicated on the drawings (e.g. WH-1). Provide 1/2" high lettering, white on black background. Nameplates shall be permanently secured to the unit.

C. Valves: Provide valve tags on all valves of each piping system, excluding check valves, valves within equipment, faucets, stops and shut-off valves at fixtures and other repetitive terminal units. Provide brass tags or plastic laminate tags. Prepare and submit a tagged valve schedule, listing each valve by tag number, location and piping service. Mount in glazed frame where directed.

2.05 EQUIPMENT SUPPORT FRAMES:

A. Unless specifically noted otherwise, it shall be the responsibility of Plumbing Contractor to furnish and install all support frames for its equipment.

PART 3 - EXECUTION

3.01 SCHEDULING OF WORK:

A. All work shall be scheduled subject to the approval of the Engineer and Owner. No work shall interfere with the operation of the existing facilities on or adjacent to the site.

3.02 CONDUCT OF WORK:

A. The Contractor shall have at all times, as conditions permit, a sufficient force of workmen and quantity of materials to install the work contracted for as rapidly as possible consistent with

good work, and shall cause no delay to other Divisions engaged upon this project or to the Owner.

B. Plumbing Contractor shall arrange for all cutting necessary for the proper installation of its work, providing all sleeves and chases necessary. Cutting shall not be done in such a manner to impair the strength of the structure. Any damage resulting from work shall be repaired by the Contractor at his expense to the satisfaction of the Engineer.

C. Progressively, daily at the completion of each day's work, and at completion of the job, the Contractor shall thoroughly clean all of his work, removing all debris, stain and marks resulting from his work.

D. IAQ Management plan will be in effect for LEED Certification. Adhesives and mastic must comply with low VOC requirements and documentation (MSDS, etc.) shall be provided with submittals.

3.03 EXCAVATION AND BACKFILL:

A. Excavation: Trenches are to be excavated to grade and depth established by drawings. Unless otherwise noted, minimum earth cover above top of pipe shall be 24", not including base and paving in paved areas. Width of trenches at top of pipe shall be a minimum of 16" plus the outside diameter of the pipe. Provide all shoring required by site conditions. Barrel of pipe shall have uniform support on trench bottom, hand excavate additional depth at bells, hubs and fittings. Where over-excavation occurs, provide compacted selected backfill to pipe bottom. Where ground water is encountered, remove to keep excavation dry, using well points and pumps as required.

B. Backfill:

1. Around Pipe and to One Foot Above Pipe: Material shall be river run sand or native granular free flowing material, free of clay lumps, silt or vegetable matter and shall have 100% passing through the No. 4 sieve and a maximum of 3% passing through the No. 200 sieve. Place carefully around and on top of pipe, taking care not to disturb piping. Consolidate with vibrator.
2. One Foot Above Pipe to Grade: Material to be sandy or silty loam, free of lumps, laid in 6" layers, uniformly mixed, to proper moisture and compacted to required density. If backfill is determined to be suitable and required compaction is demonstrated by laboratory test, water compaction in 6" layers may be used, subject to approval by the Engineer.
3. Remove all water sensitive settlement from trench backfill regardless of location and compaction requirements.

C. Compaction: Compact to a density of 95% within building and 90% outside building. Demonstrate proper compaction by testing at one-half of the trench depth. Perform three tests per 100' of trench.

3.04 OPENINGS, CUTTING AND PATCHING:

A. The locations and dimensions for openings through walls, floors, ceilings, foundations, footings, etc. required to accomplish the work under this Specification Division shall be provided under this Division. The actual openings and the required cutting and patching shall be provided. Coring through existing concrete or masonry walls, floors, ceilings, foundations, footings, etc., and saw cutting of concrete floors or asphaltic concrete required to accomplish the work under this Specification Division shall be provided under this Division. Patching of these surfaces shall also be provided. Cutting and coring shall not impair the strength of the structure. Any damage resulting from this work shall be repaired at the Contractor's expense to the satisfaction of the Engineer.

3.05 MANUFACTURER'S RECOMMENDATIONS:

A. All material, equipment, devices, etc., shall be installed in accordance with the recommendations of the manufacturer of a particular item. The Contractor shall be responsible for all installations contrary to the manufacturer's recommendations. The Contractor shall make all necessary changes and revisions to achieve such compliance. Manufacturer's installation instructions shall be delivered to and maintained at the job site through the construction of the project.

3.06 QUIETNESS:

A. Piping and equipment shall be arranged and supported so that vibration is a minimum and is not carried to the building structure or spaces.

3.07 DAMAGES BY LEAKS:

A. The Contractor shall be responsible for damages to other work caused by leaks in the temporary or permanent piping systems prior to completion of work and during the period of the guarantee, and for damages to other work caused by disconnected pipes or fittings, and the overflow of equipment prior to completion of the work.

3.08 CLEANING:

A. Progressively and at completion of the job, the Contractor shall thoroughly clean all of his work, removing all debris, stain and marks resulting from his work.

*** END OF SECTION ***

SECTION 22 00 01 PLUMBING

PART 1 - GENERAL

1.01 GENERAL CONDITIONS:

A. The foregoing Section 22 00 00, General Plumbing Provisions shall form a part of this specification.

1.02 SCOPE:

A. Included: Perform all work necessary and required to complete construction as indicated. Such work includes the furnishings of all labor, materials and services necessary for a complete, lawful and operating plumbing system with all equipment as shown or noted on the drawings or as specified herein. The work includes, but is not necessarily limited to, the following:

1. Sanitary sewer system.
2. Domestic water system.
3. Plumbing fixtures.
4. Plumbing equipment.
5. Condensate drains.
6. Storm drain system.
7. Gas piping.

B. Work Specified Elsewhere:

1. Line voltage power wiring (60 volts or greater), motor starters in motor control centers, and disconnect switches are included in the Electrical Division, unless otherwise noted.
2. Access doors.
3. Concrete and reinforcing steel.
4. 23 00 01, Heating, Ventilating and Air Conditioning.

1.03 CODES AND STANDARDS:

A. All pipe, pipe or plumbing fittings or fixture, solder, or flux shall be lead free that provides water for human consumption per California Assembly Bill 1953 (AB1953).

B. See Section 22 00 00 for additional requirements.

1.04 SUBMITTALS:

A. Provide product data for all materials per Division 01.

PART 2 - MATERIALS

2.01 PIPING MATERIALS:

A. Sanitary Sewer:

1. Soil, Waste and Vent Piping:
   a. Inside Building and Within Five Feet of Building Walls: Standard weight coated cast iron pipe and fittings. Plain end with neoprene gasket and stainless steel retaining sleeve, CISPI 301, ASTM A888 hubless cast-iron, or hub end with rubber gasket, ASTM A74, ASTM C564. Size 2” and smaller above grade may be standard weight galvanized steel, ASTM A53, with coated cast iron recessed drainage fittings, ANSI B16.12. All cast iron pipe and couplings shall be American made and tested, no imported pipe or coupling is acceptable. Use heavy-duty (4-Band) couplings for all soil

and waste piping. Use standard (2-Band) couplings for all vent piping. Tyler Pipe, AB & I Foundry or Charlotte Pipe. Couplings shall be Tyler, Anaco or Husky.

OR

a. Inside Building and Within Five Feet of Building Walls: PVC-DWV sewer pipe with solvent weld, ASTM D2665. Schedule 40 wall thickness. Traps, sink outlets, cleanouts, etc., shall be same material. Traps shall have union connections.
   i. Piping over food prep centers, food serving facilities, food storage areas and other critical areas shall be kept to a minimum and shall not be exposed.
b. Outside Building:
   FOR STATE JOBS, DELETE PLASTIC PIPE FROM DRAINAGE SECTION PER AMENDMENT TO UPC, 701.1.
   i. For domestic waste only: Polyvinyl chloride gravity sewer pipe with bell and rubber Z-gasket, ASTM D3034, SDR 35. Carlon, J.M.
   ii. PVC-DWV sewer pipe with solvent weld, ASTM D2665. Schedule 40 wall thickness. Traps, sink outlets, cleanouts, etc., shall be same material. Traps shall have union connections.
   iii. Where cover is less than 15", pipe shall be cast iron, same as for inside of building.

2. Acid Waste: Polypropylene pipe, vent, and mechanical compression joint and fittings, ASTM D2146(D), or thermally fused joints joined by the use of electrical resistance coils within fittings. Flame retardant in accordance with ASTM D635 and UL 94 for piping above grade. Schedule 40 wall thickness. Traps, sink outlets, cleanouts, etc., shall be same material. Traps shall have union connections. Lab Line/ Enfield, GSR Fuseal, Orion Blueline or Zurn.

OR

2. Acid Waste: PVC-DWV sewer pipe ASTM D2665 with solvent weld. Schedule 40 wall thickness. Traps, sink outlets, cleanouts, etc., shall be same material. Traps shall have union connections.
3. Cleanouts: Floor cleanouts: Smith 4020 with nickel bronze top in finished areas; Smith 4220 in utility areas. Wall cleanouts: Smith 4530 with stainless steel cover and screw. Comparable models of Josam, Wade, Zurn or equal.
4. Cleanout Box: Precast reinforced concrete. Cast iron lid marked for service. Christy or equal; F22 in foot traffic area; G5 in roadways.

B. Storm Drain:

1. Piping:
   a. Inside Building and Within Five Feet of Building walls: Same as Soil, Waste, and Vent Piping.
   b. Outside Building:
      i. 10" and Smaller: Standard strength non-reinforced concrete bell and spigot, ASTM C14, or Polyvinyl chloride gravity sewer pipe with bell and rubber Z-gasket, ASTM D3034, SDR 35. Carlon, J.M. Where cover is less than 15", same as for inside building.
      ii. 12" and Larger: Reinforced concrete, Class III, 2000 D-load, ASTM C76.
      iii. Fittings: Fittings and couplings shall be specifically designed for the type of pipe used. Fittings and couplings designed for perforated or under drain piping will not be allowed.

C. Water, and Gas:

1. Hot and Cold Water, Piping:
   a. Inside Building: Type L hard temper seamless copper, ASTM B88. Wrought copper fittings ANSI B16.22. Vacuum pipe shall have long sweeping elbow fittings. 95/5 tin-silver soldered joints. Brazesafe, Silcan or equal brazing material.
   b. Outside Building Below Grade: Same as Inside Building with protective coating on ferrous pipe or Schedule 40 PVC pipe thru 2", Class 315 2" thru 4".
2. Gas Piping:

a. Above Grade: Schedule 40 black steel pipe, ASTM A120. 150 psi black malleable iron screwed fittings, ANSI B16.3, ANSI B31.8. Galvanized pipe and fittings will not be allowed. Flexible connections shall be convoluted brass with dielectric couplings, AGA approved. Outside building flexible connections shall be convoluted stainless steel with dielectric couplings, AGA approved. Prime and paint all piping.
b. Outside Building – Below Grade: Same as Inside Building – Above Grade, with protective coating of ferrous pipe or medium density polyethylene (MDPE) PE2708 or PE2406 pipe manufactured in accordance with ASTM D2513 and IAPMO Standards.

D. Condensate Drain Piping: Same as cold water piping.

E.. Valves and Specialties:

1. Valves:
   a. General: Manufacturer's model numbers are listed to complete description. Milwaukee, Kitz, Apollo, Nibco, Stockham or equal. All valves shall be full size of upstream piping. Ball valves shall be substituted for gate valves 2" and smaller. Butterfly valves shall be substituted for gate valves 2-1/2" and larger. C_V factors for ball valves shall not be less than equal size gate valves.
   b. Gate Valve: 2" and smaller: All bronze, rising stem, union bonnet, wedge disk, 200 psi WOG. Milwaukee No. 1152. The material of the valve stem shall be limited to a maximum of six (6) percent zinc content. 2-1/2" and larger: Iron body, bronze mounted. Non-rising stem. Wedge disk. 200 psi WOG. Flanged or AWWA hub as applicable. Open/ closed indicator. Milwaukee No. F2882. Underground valves shall have square operating nut.
   c. Check Valve: 2" and smaller: All bronze swing check, regrinding. 200 psi WOG. Milwaukee No. 509, 1509 or equal. 2-1/2" and larger: Non-slam type, 125 psi iron body wafer type with renewable seats and stainless steel spring. Milwaukee 1400 series or equal.
   d. Plug Valve: Eccentric bronze plug. Nickel chromium alloy iron body. Bronze bushings. Buna-N O-rings. UL approved for gas distribution. 175 psi WOG. DeZurick Series 400 or equal.
   e. Ball Valves: Two or three piece construction, forged bronze body, chrome plated brass ball, threaded ends, teflon seats, PTFE or reinforced teflon stem seals, lever handle. Underground valves shall have "T" handle. Provide one operating "T" extension handle for all underground valves. Milwaukee BA100/150, BA300/350, Nibco or equal.
   f. Gas Valves: 2" and smaller, Milwaukee BB2-100; 2-1/2" and larger, Rockwell #142 or equal.
   g. Valve Box: Precast reinforced concrete. Cast iron lid marked for service. Christy or equal; F22 in foot traffic areas: G5 in roadways.
   h. Butterfly Valve: Iron Body, Aluminum bronze disk (connection to shaft shall not be by pins, screws or bolts). Ductile body PPS coated with EPPM coated ductile disc. O-ring seals. Resilient removable seat. 416 stainless steel two piece shaft. 6" and smaller valves shall have multi-position lever handle. Underground valves shall have square operating nut. Provide one operating "T" handle for underground valves. Provide 2" extension neck at insulated pipes. Milwaukee "C" series, Kitz or equal.
2. Miscellaneous Specialties:
   a. Temperature and Pressure Relief Valve: ASME rated fully automatic, reseating combination temperature and pressure relief valve sized in accordance with energy input. Sensing element immersed within upper 6" of tank. Watts.
   b. Union: 2" and Smaller: AAR malleable iron, bronze to iron ground seat. 300 psi.
   c. Dielectric Coupling: Insulating coupling rated for 250 psig. EPCO or equal.
   d. Shock Absorbers: Sioux Chief "Hydra-Rester", Zurn "Shoktrol", PPP "SC Series" or equal.

G. Flue Piping:

1. Gas Flue Piping: Flue pipe shall be type as recommended by equipment manufacturer for which the pipe is connected to. UL listed. Metalbestos, Amerivent or equal.
2. Flue Cap: Designed to properly ventilate flue regardless of wind direction. Storm proof, bird proof. Metalbestos, Amerivent or equal.

H. Miscellaneous Piping Items:

1. Pipe Support:
   a. Pipe Hanger: Adjustable split ring, swivel hanger and rod. Black malleable iron. Size and maximum load per manufacturer's recommendation. Felt lined, B-Line B3690F, Unistrut or equal.
   b. Construction Channel: 12 gage 1-5/8" x 1-5/8" steel channel. Single or multiple section. Self-locking nuts and fittings. B-Line, Unistrut, Superstrut or equal.
2. Pipe Sleeves: 24 gage galvanized steel. Adjus-to-Crete #10 with #99 thimble for floors. #100 for walls.
3. Flashing: Vent flashing and flashing for piping through roof shall be prefabricated 24 gauge galvanized steel roof jacks with 8" square flange around pipe. For tile or other roofing systems where pliable flashing is required, flashing shall be lead. Seal with weatherproofing mastic.

2.02 PIPING INSULATION MATERIALS:

A. General: All piping insulation materials shall have fire and smoke hazard ratings as tested under ASTM E-84 and UL 723 not exceeding a flame spread of 25 and smoke developed of 50.

B. Pipe Insulation: Elastomeric type, ASTM C534, with a thermal conductivity of 0.27 at 75°F when measured in accordance with ASTM C177 or ASTM C518.

1. Wall thickness: 3/4 in.
2. Adhesive: Conform to Manufacturer's recommendations.

C. Pre-molded Fiberglass: Heavy density sectional pre-molded fiberglass with vapor barrier laminated all-service jacket and pressure sealing vapor barrier lap. Thermal conductivity shall not exceed 0.25 Btu-in/hr-sq. ft-degrees F, at a mean temperature of 50 degrees F. Perm rating 0.02, ASTM E96. Puncture rating 50 Beach units, ASTM D781. Provide 3" (min.) wide tape of same material as lap for butt joints. For hot water piping, thickness shall be 1" for pipe sizes less than 2", 1-1/2" thickness for pipe sizes 2" and larger. CSG Insulation Corp., Manville, Owens-Corning or equal.

D. Fiberglass Blanket: Unfaced. Thermal conductivity shall not exceed 0.25 Btu-in/hr sq. ft-degrees F, at a mean temperature of 50 degrees F. 1-1/2" thickness. Manville, Owens-Corning or equal.

E. PVC Jacket (for exposed pipes and fittings): Pre-molded polyvinyl chloride (PVC) jackets. Size to match application. Provide PVC vapor barrier, pressure-sealing tape by same manufacturer. Zeston or equal.

2.03 FIXTURES:

A. General: This Division shall rough-in for and install all plumbing fixtures shown on drawings. All trim not concealed shall be brass with polished chromium plate finish unless otherwise noted. All enameled fixtures shall be acid resisting. Standard color is white unless otherwise noted.

B. Schedule: Refer to Plumbing Fixture Schedule on the drawings for list of fixtures. Manufacturer's model numbers are listed to complete description. Water consumption quantities listed on schedule are maximum. Equivalent models of American Standard, Crane,

Haws, Kohler, Eljer, Zurn or equal. For drainage fixtures, equivalent models of Josam, Smith, Wade, Zurn or equal.

1. Accessibility Notes:

a) Plumbing fixtures and accessories provided in a toilet room or bathing room required to comply with CBC Section 11B-213.2 shall comply with CBC Section 11B-213.3.

b) Effective March 1, 2017m all single user toilet facilities shall be identified as Gender Neutral facilities by a door symbol that complies with CBC Sections 11B-216.8 and 11B-703.7.2.6.3. No pictogram, text or braille is required on the symbol. If tactile requirements of CBC Section 11B-703.

c) Accessible plumbing fixtures shall comply with all the requirements in CBC Division 6.

d) Clearance around accessible water closets and in toilet compartments shall be 60 inches minimum measured perpendicular from the sude wall and 56 inches minimum measured perpendicular from the rear wall per CBC Section 11B-604.3.1.

e) Heights and location of all accessible fixtures shall be mounted according to CBC Section 11B-602 through 11B-612.

f) Accessible fixture controls shall comply with CBC Section 11B-602.3 for drinking fountains, 11B-604.6 for water closets, 11B-604.9.5 for children's water closets, 11B-605.4 for urinals, 11B-606.4 for lavatories and sinks, 11B-607.5 for bathtubs, 11B-608.5 for showers, and 11B-611.3 for washing machines and clothes dryers.

g) Accessible lavatories and sinks shall be mounted with the front of the higher of the rim or counter surface 34" maximum above the finish floor or ground. Depth of lavatories or sinks shall not interfere with knee and toe clearance provided in accordance with CBC Section 11B-306 when a forward approach is required. CBC Section 606.3 and 11B-606.7.

h) Water supply and drainpipes under accessible lavatories and sinks shall be insulated or otherwise configured to protect against contact. There shall be no sharp or abrasive surfaces under accessible lavatories and sinks. CBC Section 11B-606.5.

2. Cal Green Notes, Non-Residential Water Conserving Plumbing Fixtures and Fittings, CCR Title 24, Part 11, Section 5.303.3:

a) For occupancies within the authority of the California Building Standarcs Commission as specified in Section 103, the provisions of Sections 5.303.3 and 5.303.4 shall apply to new fixtures in additions or areas of alteration to the building.

b) Standards for plumbing fixtures and fittings: Plumbing fixtufe and fittings shall be installed in accordance with the California Plumbing Code, and shall meet the applicable standards references in Table 1701.1 of the California Plumbing Code and in Chapter 6 of this code.

c) Water Closets: effective flush volume shall not exceed 1.28 gallons per flush.

d) Urinals: effective flush volume of wall-mounted shall not exceed 0.125 gallons per flush.

e) Showerheads:

1) Single showerhead: shall have a maximum flow rate of not more than 1.8 gallons per minute at 80 psi.

2) Multiple showerheads: when a shower is served by more than one showerhead, the combined flow rate of all showerheads and/or other shower outlets controlled by a single valve shall not exceed 1.8 galloms per minute at 80 psi, or the shower shall be designed to allow only one shower outlet to be in operation at a time.

f) Faucets and fountains:

1) Lavatories: faucets shall have a maximum flow rate of not more than 0.5 gallons per minute at 60 psi.

2) Kitchen: faucets shall have a maximum flow rate of not more than 1.8 gallons per minute at 60 psi. Kitchen faucets may temporarily increase the flow above the maximum rate, but not to exceed 2.2 gallons per minute at 60 psi, and must default to a maximum flow rate of 1.8 gallons per minute at 60 psi.

3) Wash fountains shall have a maximum flow rate of not more than 1.8 gallons per minute/20 [rim space (inches) at 60 psi].

4) Metering faucets shall not deliver more than 0.20 gallons per cycle / 20 [rim space (inches) at 60 psi].

5) Where complying faucets are unavailable, aerators or other means may be used to achieve reduction.

g) Commercial kitchen equipment:

1) Food waste disposers shall either modulate the use of water to o more than 1 gpm when the disposer is not in use (not actively grinding food waste/no-load) or shall automatically shut off after no more than 10 minutes of inactivity. Disposers shall use no more than 8 gpm of water.

h) Cal-Green section 5.303.4.1 code section does not affect local jurisdiction authority to prohibit or require disposer installation.

C. Stops and P-traps: All fixtures shall be provided with stops and p-traps as applicable.

1. Stops: All hot and cold water supplies shall be 1/2" angle stops with IPS inlets and compression outlets, stuffing box, screw driver lock shield, and 1/2" flexible brass tubing riser. Speedway. Wall mounted trim shall have concealed loose key wall stop. Chicago 1771 or equal.
2. P-traps: Brass, ground joint. 17 gage. American Standard, California Tubuler or equal.
   a. Trap primers shall be provided with ball valve and cylinder key-lock access panel for all floor drains and floor sinks. PPP, Inc. or equal.

2.04 EQUIPMENT:

A. General Requirements:

1. General: These equipment specifications are to supplement the drawings. Refer to schedules on drawings for the specific equipment to be provided. Capacities shall be in accordance with the schedules shown on the drawings. Capacities are to be considered minimum.

2. Dimensions: Equipment must conform to space requirements and limitations as indicated on the drawings and as required for operation and maintenance. Equipment will not be accepted that does not readily conform to space conditions.
3. Ratings: Electrical equipment shall be in accordance with NEMA Standards and UL listed where applicable standards have been established.
4. Basis of Design: Manufacturers and model numbers listed in schedules as the basis of design are intended to represent the standard of quality and the features desired.
5. Piping: Each item or assembly of items shall be furnished completely piped for connection to services. Control valves and devices shall be provided. Equipment requiring domestic water for non-potable use shall be provided with backflow preventer acceptable for intended use by local governing authorities.
6. Electrical:
    a. General: Each item or assembly of items shall be furnished completely wired to individual terminal blocks for connection to single branch electrical circuit. All electrical accessories and controls required by equipment shall be furnished. Provide terminal blocks for controls not included in equipment package. Manual and magnetic starters shall have ambient compensating running over-current protection in all ungrounded conductors. Magnetic starters shall be manual reset. Controllers and other devices shall be in NEMA 3 or 12 enclosures as applicable.
    b. Wiring: Conductors, conduit, and wiring shall be in accordance with Electrical Specifications. Individual items within assembly shall be separately protected with dead front, fused disconnect, fuse block, or circuit breaker for each ungrounded conductor, all accessible on operating side of equipment. Switches, contacts and other devices shall be in ungrounded conductors.
    c. Motors: Shall be rated, constructed and applied in accordance with NEMA and ANSI Standards without using service factor. Single-phase motor shall be of type to suit application. Three-phase motors shall be open drip-proof, NEMA B design on pumps and fans, NEMA C on reciprocating equipment, sealed ball bearing, three-phase induction. Design shall limit starting inrush current and running current to values shown on drawings.
    d. Starters: Motor starters shall be provided for all equipment except where starter is in a motor control center as designated on the electrical drawings.
    e. Control Voltage: Equipment connected to greater than 240 volts shall be provided with 120 volt transformer if separate source is not indicated on plans. 240 volt control is acceptable if confined within control panel.
    f. Submittals: Included in shop drawings shall be internal wiring diagrams and manufacturer's recommended external wiring.

B. Electric Drinking Fountain: Wall hung, Dual height with Bottle Filler. Provide steel mounting brackets. Stainless steel basin. Removable grid drain. Chrome plated brass bubbler with automatic flow regulator and self-closing valve. Nonferrous evaporator. Hermetic compressor with automatic reset overload protection. Air cooled condenser. Adjustable thermostat. UL listed. ARI certified. Oasis, Sunroc.

C. Water Heater, Gas: Glass lined tank. 150 psi working pressure. Fully insulated. Automatic temperature control. High limit control. Provide ASME rated temperature and pressure relief valve sized in accordance with energy input, dielectric couplings and drain cock. AGA and CEC approved. Extended warranty for a period of 5 years minimum. State, A.O. Smith, National , Rheem or equal.

D. Water Heater, Instantaneous Gas: 150 psi working pressure. Automatic temperature control. High limit control. Direct vent sealed combustion with category III stainless steel venting. Coated copper heat exchanger. Provide with remote control panel. AGA and CEC approved. Extended warranty period of 5 years minimum. Nortiz, Rheem, Takagi or equal.

E. Water Heater, Electric: Glass lined tank. 150 psi working pressure. Fully insulated. Automatic temperature control. High limit control. Provide ASME rated temperature and pressure relief valve sized in accordance with energy input, dielectric couplings and drain cock. UL listed and CEC approved. Extended warranty for a period of 3 years minimum. State, A.O. Smith, National, Rheem or equal.

F. Water Heater, Instantaneous Electric: Tankless, automatic temperature control. High limit control. Provide microprocessor controls. UL listed and CEC approved. Warranty for a period of 1-year minimum. Rheem, Chronomite, Eemax or approved equal.

G. Sewage Pumps:

1. General: Furnish all labor, materials, equipment and incidentals required to provide duplex pumping system as specified herein. The system shall be by the same manufacturer as supplying the pump and motor control panel. Hydro-pneumatic Pumps or equal.
2. System shall consist of sewage grinder pumps with explosion proof motors, level control switches, discharge plumbing with hydraulically sealed discharge flange, pump mounting plates with bottom rail supports, upper rail supports, lifting chain, pedestal mount and cord sealing plate for panel or NEMA 4 junction box; to be installed in factory fabricated fiberglass basin with cover. A NEMA 4X weatherproof control box shall be supplied for mounting at the sump site or remote from the basin as required. Structure and dimensions to be as shown on drawings.
3. Sump Level Controls: Float switches shall be supplied to control sump level and alarm signal. The switches shall be sealed in a solid polypropylene float for corrosion and shock resistance. The support wire shall have a heavy Neoprene jacket. A weight shall be attached to cord above the float to hold switch in place in sump and efficiently prevent sharp bends in the cord when the float operates. A quantity of 4 floats shall be provided to control level. An additional switch shall be provided with alarm.
4. Check Valve and Piping: The discharge piping shall include a ball check valve with hydraulically sealed discharge flange and gate valve for each pump. Discharge from station shall be fitted with NPT couplings.
5. Basin Cover: Cover shall be of gas tight steel construction with an O.D. equal to the O.D. of the top flange on the basin. Cover shall be secured by the stainless steel bolts and coated with a 3-4 mil thick rust-inhibiting paint.

H. Circulation Pump: Bronze pump with stainless steel or non-metallic impeller. Shaft shall be stainless steel or ceramic with carbon bearings with EPDM O-ring and gaskets. Replaceable cartridge type circulators shall have stainless steel cartridge. Connections shall be sweat, threaded or flanged. Taco, Bell & Gossett, Grundfos, Armstrong or equal.

PART 3 - EXECUTION

3.01 PIPING INSTALLATION:

A. General:

1. Piping Layout: Piping shall be concealed in walls, above ceilings, or below grade unless otherwise noted. Exposed piping shall run parallel to room surfaces; location to be approved by Owner's Representative. No structural member shall be cut, notched, bored or otherwise altered unless specifically allowed by structural drawings and/or specifications. Where such cutting is required, reinforcement shall be provided as specified or detailed. All piping shall be installed in a manner to ensure unrestricted flow, eliminate air pockets, prevent any unusual noise, and permit complete drainage of the system. All piping shall be installed to permit expansion and contraction without strain on piping or equipment. Expansion joints shall be installed as required. Vertical lines shall be

installed to allow for building settlement without damage to piping. All exposed piping to be primed and painted, see painting section.

2. Joints:
   a. Threaded: Pipe shall be cut square, and reamed to full size. Threads shall be in accordance with ANSI B2.1. Joint compound or tape suitable for conveyed fluid shall be applied to male thread only. Joints shall be made with three threads exposed.
   b. Welded or Brazed: Filler rod shall be of the same suitable alloy as pipe. Welding or brazing shall be performed in accordance with requirements of recognized published standards of practice and by licensed or otherwise certified contractors. Welder or Brazer shall be a person who specialized in welding or brazing of pipes and holds a recognized certificate of competency from a recognized testing laboratory, based on the requirements of the ASME Boiler and Pressure Vessels Code, Section 9.
   c. Other: Joints other than threaded or welded shall be installed in accordance with manufacturer's recommendations.
   d. Open Ends: Open ends of piping shall be capped during progress of work to preclude foreign matter.
   e. Electrical Equipment: Joints shall be avoided, where possible, over electrical equipment.
   f. Copper pipe 1-1/2” or less may be soldered. Above 1-1/2” and all below grade shall be brazed.
3. Fittings:
   a. Standard Fittings: All joints and changes in direction shall be made with standard fittings. Close nipples shall not be used.
   b. Reducers: Pipe size reduction shall be made with bell reducer fittings. Bushings shall not be used.
   c. Unions: A union shall be installed on the leaving side of each valve, at equipment connections, and elsewhere as necessary for assembly or disassembly of piping.
   d. Valves: All valves shall be full line size. At equipment connections, valves shall be full size of upstream piping.
4. Pipe Support:
   a. General: Hangers shall be placed to support piping without strain on joints or fittings. Maximum spacing between supports shall be as specified below. Actual spacing requirements will depend on structural system. Refer to drawings for additional requirements and attachment to structure. Vertical piping shall be supported at floor and ceiling. Support pipe within 12" of all changes in direction. Support individual pipes with pipe hanger. All pressure piping, drainage piping above grade and metallic piping of dissimilar metal from hangers shall have isolating shield, or felted hangers.
      i. Screwed Pipe:

Pipe Size Between Supports*	Max. Spacing
(in)	(ft)
½	6
¾	8
1	8
1-1/4 & larger	10

      * Based on straight lengths of pipe with couplings only. Provide additional supports for equipment, valves or other fittings.

      ii. Copper Tubing: Copper tubing shall be supported at approximately six (6) foot intervals for piping one and one-half (1-1/2) inches and smaller in diameter and ten (10) foot intervals for piping two (2) inches and larger in diameter.
      iii. Gravity Drain Pipe: Piping shall be supported at each length of pipe or fitting, but in no case at greater spacing than indicated above for pressure pipe.
   b. Trapeze: Trapeze hangers of construction channel and pipe clamps may be used. Submit design to Engineer for approval.

5. Excavation and Backfill: Minimum cover on all piping shall be as follows unless otherwise noted:
   a. Up to 2-1/2" pipe - 24" cover.
   b. 3" and larger pipe - 30".
6. Miscellaneous:
   a. Escutcheons: Provide chromium plated escutcheons where piping penetrates walls, ceilings or floors in finished areas.
   b. Pipe Sleeves: All piping passing through concrete shall be provided with pipe sleeves. Allow 1" clearance between sleeve and pipe or pipe insulation.
   c. Dielectric Couplings: Dielectric couplings shall be installed wherever piping of dissimilar metals are joined.
   d. Shock Absorbers: Install per manufacturers recommendations.

B. Sanitary Sewer Piping:

1. General: Where inverts are not indicated, sanitary sewer piping shall be installed at 1/4" per foot pitch. Piping 4" and larger may be installed at 1/8" per foot pitch where structural or other limitations prevent installation at a greater pitch.
2. Cleanouts: Install cleanouts at ends of lines, at changes of direction greater than 45 degrees, and at not greater than 100 foot intervals. Locate interior cleanouts in accessible locations and bring flush to finished surface. Cleanouts at urinals shall be installed above urinal.
3. Vents: Vents shall terminate not less than 6" above the roof nor less than 12" from any vertical surface nor within 10 feet of any outside air intake. Install horizontal vent lines at 1/4" per foot pitch. Offset vents 2 feet minimum from gutters, parapets, ridges and roof flashing.

C. Water Piping: Connections to branches and risers shall be made from the side of the main. Supply header in fixture battery shall be full size to last fixture, reducing in size only on individual connections to each fixture in battery. Provide ball valve shutoff for each building and at each connection to equipment and trap primers. Shock absorbers shall be installed in a vertical position at end of branch runs as specified in this section whether specifically shown or not on drawings. Connections to equipment shall be made with flexible connectors. Non-metallic pipe shall have 18 AWG copper tracer wire laid on top of pipe and taped in place at 15-foot spacing, terminate 4" above grade at ends of pipe runs.

D. Gas Piping: Shall be pitched to drain to drip legs at each piece of equipment. No unions shall be installed except at connections to equipment. Provide shutoff at each equipment connection. Connections to equipment shall be made with flexible connectors. Under floor piping shall be sleeved, sealed and vented. Polyethylene or polyvinyl chloride pipe and fittings shall be joined in accordance with manufacturer's recommendation. Metal-to-plastic transition fittings shall be installed at all transitions. Non-metallic pipe shall have 18 AWG copper tracer wire laid on top of pipe and taped in place at 15-foot spacing, terminate 4" above grade at ends of pipe runs. All gas below grade shall have continuous caution tape installed 12” above gas line. All exposed gas piping shall be primed and painted, see painting section.

E. Condensate Drain Piping: Install with constant pitch to receptacle, 1/4" per foot where possible, otherwise 1/8" per foot minimum. Provide trap at each air handling unit to prevent air leakage. Connections to equipment shall be made with flexible connection unless connection is internally isolated.

F. Storm Drain Piping: Install at 1/4" per foot pitch.

G. Flue Piping: Flue piping shall be installed in accordance with its UL listing and manufacturer’s instructions.

3.02 PIPING INSULATION INSTALLATION:

A. Domestic Tempered Water Supply:

1. General: All domestic tempered water supply piping, except for exposed connections to fixtures, shall be insulated. Do not insulate unions or valves less than 2", unless exposed to weather.
2. Install elastomeric pipe insulation by slipping over end of pipe. Where not feasible, slit insulation longitudinally, snap over piping and seal with adhesive. Insulate fittings with larger diameter sleeves or insulation, lapping pipe insulation a minimum of 2 in.
3. Butt sections of insulation tightly together and seal with adhesive to provide a continuous vapor and thermal barrier.
4. Pipe: Apply pre-molded fiberglass sections to pipe using integral pressure sealing lap adhesive in accordance with manufacturer's recommendations. Stagger longitudinal joints. Seal butt joints with factory supplied sealing tape.
5. Fittings and Valves:
   a. Wrap fitting with pre-cut fiberglass blanket to thickness matching adjoining insulation. Cover blanket with PVC jacket in accordance with manufacturer's recommendations. Seal all joints with factory supplied pressure sealing vapor barrier tape with 2" (min.) overlap on both sides of joint. Insulate valves to stem.
   b. For miscellaneous fittings for which PVC jackets are not available or where proximity of fittings precludes a neat-appearing installation, the contractor may cover the fiberglass blanket with stretchable glass fabric and at least two coats of vapor barrier coating. All exposed ends of insulation shall be adequately sealed.

B. ADA Compliant Fixtures:

1. At sinks/ lavatories which are to be ADA Compliant, the p-trap and angle stop assemblies shall be insulated with Trap Wrap Protective Kit 500R by Brocar, Truebro Handi Lav-Guard #102W or #105W or equal. Abrasion resistant exterior cover shall be smooth and have 1/8" wall minimum over cushioned foam insert. Fasteners shall remain substantially out of sight.

OR

C. ADA Compliant Fixtures:

1. At lavatories which are to be ADA Compliant the P-Trap and angle stop assemblies & water heater shall be covered with Truebro Lav-Shield, or equivalent. Abrasion resistant exterior cover shall be smooth. Fasteners shall be tamper resistant.

3.03 FIXTURE INSTALLATION:

A. Fixture Height: Shall be standard height except those specified as ADA Compliant. Such fixtures shall be mounted in accordance with CBC, Section 11B, Division 6 and drawing details.

B. Wall Hung Fixtures: Shall be provided with proper backing and hanger plates secured to wall. Fixtures mounted on carriers shall bear against stop nuts, clear of wall surface. Caulk fixtures against walls with white G.E. “Sanitary SCS1700” silicone sealant. Caulking shall be smooth and flush with fixture surface (not concave).

C. Floor Drains or Floor Sinks: Shall be placed parallel to room surfaces, set level, flush with floor and adjusted at proper height to drain and easily accessible for inspection and cleaning. Cover openings during construction to keep all foreign matter out of drain line.

D. Other Connections: Rough-in and connection for trim or fixtures supplied by others shall be included in this specification section.

E. Floor Mounted Fixtures: Shall be provided with proper support plates. Caulk fixtures against floors with white G.E. “Sanitary SCS1700” silicone sealant. Caulking shall be smooth and flush with fixture surface (not concave).

3.04 EQUIPMENT INSTALLATION:

A. General: It shall be the responsibility of the equipment installer to insure that no work done under other specification sections shall in any way block, or otherwise hinder the equipment.

B. Connections to Equipment: Where size reductions are required for connections to equipment, they shall be made immediately adjacent to the equipment and, if possible, inside the equipment cabinet.

3.05 TESTS AND ADJUSTMENTS:

A. General: Unless otherwise directed, tests shall be witnessed by the Owner’s Representative. Work to be concealed shall not be enclosed until prescribed tests are made. Should any work be enclosed before such tests, the Contractor shall, at his expense, uncover, test and repair his work, and that of other contractors, to original conditions. Leaks and defects shown by tests shall be repaired and entire work retested. Tests may be made in sections. However, all connections between sections previously tested and new section shall be included in the new test. New sections shall be isolated from existing sections for testing purposes. There shall be no drop in pressure during test except that due to ambient temperature changes. All components of system not rated for test pressure shall be isolated from system before test is made. Test the new sections or branches of piping only.

B. Gravity System:

1. Sanitary Sewer: All ends of the new sections of sewer system shall be capped and lines filled with water to the top of the highest vent, 10 feet above grade minimum. This test shall be made before any fixtures are installed. Test shall be maintained until all joints have been inspected, but no less than 2 hours.
2. Condensate Piping: Maintain 15 psig water pressure for a duration of 4 hours.

C. Pressure Systems:

1. General: There shall be no drop in pressure during test except that due to ambient temperature changes. All components of system not rated for test pressure shall be isolated from system before test is made. Test the new sections or branches of piping only.
2. Domestic Tempered, Cold & DI Water Piping: Maintain 60 psig water pressure for a minimum duration of 2 hours.
3. Gas, Vacuum and Air Piping: Maintain 60 psig air pressure for a minimum duration of 2 hours.

D. Accessible Lavatories:

1. Faucet controls and operating mechanisms shall be installed and tested to comply per CBC Section 11B-606.4.

3.06 DISINFECTION:

A. Disinfect all domestic hot and cold water piping systems in accordance with California Plumbing Code Sections 609.9.1 through 609.9.4. The method to be followed shall be that prescribed by the Health Authority or, in case no method is prescribed by it, the following:
1. The pipe system shall be flushed with clean, potable water until potable water appears at the points of outlet.

2. The system or parts thereof shall be filled with a water-chlorine solution containing not less than 50 parts per million of chlorine, and the system or part thereof shall be valved-off and allowed to stand for 24 hours; or, the system or part thereof shall be filled with a water-chlorine solution containing not less than 200 parts per million of chlorine and allowed to stand for 3 hours.
3. Following the allowed standing time, the system shall be flushed with clean, potable water until the chlorine residual in the water coming from the system does not exceed the chlorine residual in the flushing water.
4. The procedure shall be repeated where it is shown by bacteriological examination made by an approved agency that contamination persists in the system.

B. Disinfection process shall be performed by certified testing agency or in cooperation with health department having jurisdiction and witnessed by a representative of the Architect. During procedure, signs shall be posted at each water outlet stating, "Chlorination - Do Not Drink". After disinfection, water samples shall be collected by certified testing agency or by health department for bacteriological analysis. Certificate of Bacteriological Purity shall be obtained and delivered to the Owner through the Owner's Representative.

*** END OF SECTION ***

SECTION 23 00 00 - GENERAL MECHANICAL PROVISIONS

PART 1 - GENERAL

1.01 GENERAL CONDITIONS:

A. The foregoing General and Special Conditions shall form a part of this Division with the same force and effect as though repeated herein. The provisions of this Section shall apply to all the Sections of Division 23.

1.02 CODES AND REGULATIONS:

A. All work and materials shall be in full accordance with current rules and regulations of applicable codes. Nothing in these drawings or specifications is to be construed to permit work not conforming to these codes. Should the drawings or specifications call for material or methods of construction of a higher quality or standard than required by these codes, the specifications shall govern. Applicable codes and regulations are:

1. California Code of Regulations – CCR:
   a. Title 8, Industrial Relations.
   b. Title 24, Building Standards.
2. California Building Code – CBC.
3. California Mechanical Code – CMC.
4. California Plumbing Code – CPC.
5. California Green Building Code.
6. Air Diffusion Council – ADC.
7. American Gas Association – AGA.
8. Air Moving and Conditioning Association – AMCA.
9. American National Standards Institute – ANSI.
10. Air Conditioning and Refrigeration Institute – ARI.
11. American Society of Heating, Refrigerating and Air Conditioning Engineers – ASHRAE.
12. American Society of Mechanical Engineers – ASME.
13. American Society for Testing and Materials – ASTM.
14. American Water Works Association – AWWA.
15. California Electrical Code – CEC.
16. National Electrical Manufacturers Association – NEMA.
17. National Fire Protection Association – NFPA.
18. Sheet Metal and Air Conditioning Contractors National Association – SMACNA.
19. Underwriters' Laboratory – UL.
20. Occupational Safety and Health Act - OSHA.

1.03 PERMITS AND FEES:

A. The Contractor shall take out all permits and arrange for all tests in connection with his work as required by local ordinances. All charges are to be included in the work. Permits for equipment connected to a particular system are to be considered as a part of the work included under each system; for example, permits for electric motor connection are part of electrical work, permits for domestic water or gas connections are part of plumbing work. All charges for service connections, meters, etc. by utility companies or districts shall be included in the work.

1.04 COORDINATION OF WORK:

A. Layout of materials, equipment and systems is generally diagrammatic unless specifically dimensioned. The actual locations of all materials, piping, ductwork, equipment, supports, etc. shall be carefully planned, prior to installation of any work, to avoid all interference’s with each other, or with structural, electrical or architectural elements. Verify the proper voltage and phase

of all equipment with the electrical plans. All conflicts shall be called to the attention of the Engineer prior to the installation of any work or the ordering of any equipment.

1.05 GUARANTEE:

A. Guarantee shall be in accordance with the General Conditions. These specifications may extend the period of the guarantee for certain items. Where such extensions are called for, or where items are normally provided with guarantee periods in excess of that called for in the General Conditions, the Certificate of Guarantee shall be furnished to the Owner through the Engineer.

1.06 EXAMINATION OF SITE:

A. The Contractor shall examine the site, compare it with plans and specifications, and shall have satisfied himself as to the conditions under which the work is to be performed. No allowance shall subsequently be made in his behalf for any extra expense to which he may be put due to failure or neglect on his part to make such an examination.

1.07 SUBMITTALS:

A. Submit shop drawings in accordance with Division 01.

B. Shop Drawings: Within 30 days of contract award, the Contractor shall submit six copies of shop drawings for all materials, equipment, etc. proposed for use on this project. Material and equipment shall not be ordered or installed until written review is processed by the Engineer. Any item omitted from the submittal shall be provided as specified without substitution. All shop drawings must comply with the following:

1. Shop drawings are required for all material and equipment items and shall include manufacturer's name and catalog numbers, dimensions, capacities, performance curves, and all other characteristics and accessories as listed in the specifications or on the drawings. Descriptive literature shall be current factory brochures and submittal sheets. Capacities shall be certified by the factory.
2. All shop drawings shall be submitted at one time in a neat and orderly fashion in a suitable binder with title sheet including Project, Engineer, and Contractor; Table of Contents; and indexed tabs dividing each group of materials or item of equipment. All items shall be marked with the specification paragraph number for which they are proposed. All equipment shall also be identified by the mark number as indicated on the drawings.
3. All capacities, characteristics, and accessories called for in the specifications or on the drawings shall be highlighted, circled or underlined on the shop drawings. Calculations and other detailed data indicating how the item was selected shall be included for items that are not scheduled. Data must be complete enough to permit detailed comparison of every significant characteristic which is specified, scheduled, or detailed.

C. Substitutions: Manufacturers and model numbers listed in the specifications or on the drawings represent the standard of quality and the features desired. Unless otherwise noted, alternate manufacturers may be submitted for review by the Engineer. Calculations and other detailed data indicating how the item was selected shall be included. The Contractor shall assume full responsibility that substituted items or procedures will meet the specifications and job requirements and shall be responsible for the cost of redesign and modifications to the work caused by these items.

D. Review: Submittals will be reviewed for general conformance with the design concept, but this review does not guarantee quantity shown, nor does it supersede the responsibility of the Contractor to provide all materials, equipment and installation in accordance with the drawings and specifications. The Contractor shall agree that shop drawing submittals processed by the Engineer are not Change Orders; that the purpose of shop drawing submittals by the Contractor

is to demonstrate to the Engineer that the Contractor understands the design concept; that he demonstrates his understanding by indicating which equipment and material he intends to furnish and install and by detailing the fabrication and installation methods he intends to use. The Contractor shall agree that if deviations, discrepancies or conflicts between shop drawings and design drawings and specifications are discovered either prior to or after shop drawing submittals are processed by the Engineer, the design drawings and specifications shall control and shall be followed.

1.08 OPERATION AND MAINTENANCE INSTRUCTIONS:

A. Submit one electronic pdf copy for review and after approved submit three hard copies of the Operation and Maintenance Instructions and Wiring Diagrams for all equipment and parts lists for all equipment, etc. shall be submitted to the Engineer. All instructions shall be clearly identified by marking them with the same designation as the equipment item to which they apply (e.g. AC-1). All wiring diagrams shall agree with revised shop drawings and indicate the exact field installation. All instructions shall be submitted at the same time and shall be bound in a suitable binder with tabs dividing each type of equipment (e.g. Fans, Motors, etc.). Each binder shall be labeled indicating "Operating and Maintenance Instructions, Project Title, Contractor, Date" and shall have a Table of Contents listing all items included. **(These submittals shall be submitted with regular submittals at start of job so Commissioning Contractor can start on the commissioning check list for LEED Certification or Title 24 Requirements)**

B. Verbal: The Contractor shall verbally instruct the Owner's maintenance staff in the operation and maintenance of all equipment and systems. The controls contractor shall present that portion of the instruction that applies to the control system. The Engineer's office shall be notified 96 hours prior to this meeting.

C. Posted: The Contractor shall prepare operation instructions for all systems which shall be typewritten, reviewed by the Engineer, and mounted under glass adjacent to the appropriate temperature control panel. These instructions shall include applicable temperature control diagrams.

D. Acknowledgment: The Contractor shall prepare a letter indicating that all operation and maintenance instructions (printed, verbal and posted) have been given to the Owner, to the Owner's satisfaction. This letter shall be acknowledged (signed) by the Owner and submitted to the Engineer.

1.09 RECORD DRAWINGS:

A. The Contractor shall maintain a set of prints for the project as a record of all construction changes made. As the Work progresses, the Contractor shall maintain a record of all deviations in the Work from that indicated on the drawings. Final location of all underground work shall be recorded by depth from finished grade and by offset distance from permanent surface structures, i.e. buildings, curbs and walks. In addition, the water, gas, under-floor ducts, etc. within the building shall be recorded by offset distances from building walls. The original drawings will be made available to the Contractor from which he shall have a set of reproducible drawings made. The Contractor shall then transfer the changes, notations, etc. from the marked-up prints to the reproducible drawings. The record drawings (marked-up prints and reproducibles) shall be submitted to the Engineer for review (as an alternative, the marked-up prints may be photocopied full size on reproducible stock).

PART 2 - PRODUCTS

2.01 PROTECTIVE COATING FOR UNDERGROUND PIPING:

A. All ferrous pipe below grade (except cast iron) shall have a factory applied protective coating of extruded high density polyethylene, 35 to 70 mils total thickness, X-Tru Coat, Scotchkote. All fittings and areas of damaged coating shall be covered with two layer double wrap of 10 mil polyvinyl tape to total thickness of 40 mils. Manville Corporation. Protective coating shall be extended 6" above surrounding grade.

2.02 CONCRETE ANCHORS:

A. Concrete Anchors shall comply with CBC 1901A.3. Steel stud with expansion anchor requiring a drilled hole; powder driven anchors are not acceptable. Minimum concrete embedment shall be 4-1/2 diameters. Minimum spacing shall be 10 diameters center-to-center and 5 diameters from center to edge of concrete. Maximum allowable stresses for tension and shear shall be 80% of the test report values "with special inspection". Anchors shall be Hilti, Philips - or Approved equal.

2.03 SEISMIC RESTRAINTS:

A. All mechanical systems (all equipment, piping, etc.) shall be provided with seismic restraints in accordance with "Guidelines for Seismic Restraint of Mechanical Systems" dated 2006 by SMACNA.

2.04 SYSTEM IDENTIFICATION:

A. Above Grade Piping: Provide markers on piping which is either exposed or concealed in accessible spaces. For piping systems, other than drain and vent lines, indicate the fluid conveyed or its abbreviation, either by preprinted markers or stenciled marking, and include arrows to show the direction of flow. Comply with ANSI A13.1 for colors. Locate markers at ends of lines, near major branches and other interruptions including equipment in the line, where lines pass through floor, walls or ceilings or otherwise pass into inaccessible spaces, and at 50' maximum intervals along exposed portion of lines. Marking of short branches and repetitive branches for equipment connections is not required.

B. Equipment: All equipment shall be identified with a plastic laminated, engraved nameplate which bears the unit mark number as indicated on the drawings (e.g. AC-1). Provide 1/2" high lettering, white on black background. Nameplates shall be permanently secured to the unit.

C. Valves: Provide valve tags on all valves of each piping system, excluding check valves, valves within equipment, shut-off valves at equipment and other repetitive terminal units. Provide brass tags or plastic laminate tags. Prepare and submit a tagged valve schedule, listing each valve by tag number, location and piping service. Mount in glazed frame where directed.

D. Controls: Label all panels, thermostats and by-pass timers with plastic laminated, engraved nameplate which bears the unit mark number as indicated on the drawings (e.g. AC-1). Provide 1/4" high lettering, white on black background. Nameplates shall be permanently secured to the unit.

2.05 EQUIPMENT SUPPORT FRAMES:

A. Unless specifically noted otherwise, it shall be the responsibility of Mechanical Contractor to furnish and install all support frames for its equipment.

PART 3 - EXECUTION

3.01 SCHEDULING OF WORK:

A. All work shall be scheduled subject to the approval of the Engineer and Owner. No work shall interfere with the operation of the existing facilities on or adjacent to the site.

3.02 CONDUCT OF WORK:

A. The Contractor shall have at all times, as conditions permit, a sufficient force of workmen and quantity of materials to install the work contracted for as rapidly as possible consistent with good work, and shall cause no delay to other Divisions engaged upon this project or to the Owner.

B. Mechanical Contractor shall arrange for all cutting necessary for the proper installation of its work, providing all sleeves and chases necessary. Cutting shall not be done in such a manner to impair the strength of the structure. Any damage resulting from work shall be repaired by the Contractor at his expense to the satisfaction of the Engineer.

C. Progressively, daily at the completion of each day's work, and at completion of the job, the Contractor shall thoroughly clean all of his work, removing all debris, stain and marks resulting from his work.

D. IAQ Management plan will be in effect for LEED Certification, including the sealing of duct ends before and during rough-in, specific requirements for the use of HVAC equipment during construction (if used at all), building flush-out, etc. Adhesives and mastic must comply with low VOC requirements and documentation (MSDS, etc.) shall be provided with submittals.

3.03 EXCAVATION AND BACKFILL:

A. Excavation: Trenches are to be excavated to grade and depth established by drawings. Unless otherwise noted, minimum earth cover above top of pipe shall be 24", not including base and paving in paved areas. Width of trenches at top of pipe shall be a minimum of 16" plus the outside diameter of the pipe. Provide all shoring required by site conditions. Barrel of pipe shall have uniform support on trench bottom, hand excavate additional depth at bells, hubs and fittings. Where over-excavation occurs, provide compacted selected backfill to pipe bottom. Where ground water is encountered, remove to keep excavation dry, using well points and pumps as required.

B. Backfill:

1. Around Pipe and to One Foot Above Pipe: Material shall be river run sand or native granular free flowing material, free of clay lumps, silt or vegetable matter and shall have 100% passing through the No. 4 sieve and a maximum of 3% passing through the No. 200 sieve. Place carefully around and on top of pipe, taking care not to disturb piping. Consolidate with vibrator.
2. One Foot Above Pipe to Grade: Material to be sandy or silty loam, free of lumps, laid in 6" layers, uniformly mixed, to proper moisture and compacted to required density. If backfill is determined to be suitable and required compaction is demonstrated by laboratory test, water compaction in 6" layers may be used, subject to approval by the Engineer.
3. Remove all water sensitive settlement from trench backfill regardless of location and compaction requirements.

C. Compaction: Compact to a density of 95% within building and 90% outside building. Demonstrate proper compaction by testing at one-half of the trench depth. Perform three tests per 100' of trench.

3.04 OPENINGS, CUTTING AND PATCHING:

A. The locations and dimensions for openings through walls, floors, ceilings, foundations, footings, etc. required to accomplish the work under this Specification Division shall be provided under this Division. The actual openings and the required cutting and patching shall be provided. Coring through existing concrete or masonry walls, floors, ceilings, foundations, footings, etc., and saw cutting of concrete floors or asphaltic concrete required to accomplish the work under this Specification Division shall be provided under this Division. Patching of these surfaces shall also be provided. Cutting and coring shall not impair the strength of the structure. Any damage resulting from this work shall be repaired at the Contractor's expense to the satisfaction of the Engineer.

3.05 MANUFACTURER'S RECOMMENDATIONS:

A. All material, equipment, devices, etc., shall be installed in accordance with the recommendations of the manufacturer of a particular item. The Contractor shall be responsible for all installations contrary to the manufacturer's recommendations. The Contractor shall make all necessary changes and revisions to achieve such compliance. Manufacturer's installation instructions shall be delivered to and maintained at the job site through the construction of the project.

3.06 QUIETNESS:

A. Piping, ductwork and equipment shall be arranged and supported so that vibration is a minimum and is not carried to the building structure or spaces.

3.07 DAMAGES BY LEAKS:

A. The Contractor shall be responsible for damages to other work caused by leaks in the temporary or permanent piping systems prior to completion of work and during the period of the guarantee, and for damages to other work caused by disconnected pipes or fittings, and the overflow of equipment prior to completion of the work.

3.08 CLEANING:

A. Progressively and at completion of the job, the Contractor shall thoroughly clean all of his work, removing all debris, stain and marks resulting from his work.

END OF SECTION 23 00 00

SECTION 23 00 01 - HEATING, VENTILATING AND AIR CONDITIONING

PART 1 GENERAL

1.1 GENERAL CONDITIONS

A. The foregoing Section 23 00 00, General Mechanical Provisions shall form a part of this specification.

1.2 SCOPE

A. Included: Perform all work necessary and required to complete construction as indicated. Such work includes the furnishings of all labor, materials, and services necessary for a complete, lawful, and operating air conditioning, heating, ventilating system with all equipment as shown or noted on the drawings or as specified herein. The work includes, but is not necessarily limited to, the following:
   1. Heating, ventilating and air conditioning equipment.
   2. Air distribution system (Ductwork, Air Terminals, etc.).
   3. System insulation.
   4. Controls and control wiring and conduit for control wiring.

B. Work Specified Elsewhere:
   1. Line voltage power wiring (60 volts or greater), motor starters in motor control centers, and disconnect switches are included in the electrical section.
   2. Connection of gas and condensate drains to equipment.
   3. Access doors.

PART 2 MATERIALS

2.1 DUCTWORK MATERIALS

A. General: All ductwork materials shall have fire and smoke hazard ratings as tested under ASTM E-84 and UL-181 not exceeding a flame spread of 25 and smoke developed of 50. All ductwork shall be per Chapter 6 of the CMC.

B. Low Velocity Metal Ductwork: Metal ductwork shall be galvanized sheet steel, ASTM A527.

C. Low Velocity Flexible Ductwork: Insulated flexible ductwork. Continuous internal liner bonded to galvanized steel wire helix. One pound per cubic foot glass fiber insulation, R-8. Thermal conductivity shall not exceed 0.13 Btu/hr. sq. ft.- degrees F at a mean temperature of 75°F. Seamless vapor barrier jacket. Each length shall have a factory installed metal sleeve at each end. Duct shall be capable of continuous operation at 1.5" of water static pressure and 4000 ft./ min. air velocity. Maximum length 5 ft., single piece at runouts to air terminals. Genflex, Lamborn or equal.

D. Fabric Ductwork (Ductsox):
   1. Ductsox Sedona XM Fabric, Fabric Air Trevira CS 150 or Approved Equal: Air diffusers shall be constructed of a woven fire retardant fabric complying with the following physical characteristics: 100% Flame Retardant Anti-Microbial with 10 year warranty Fabric Construction, Weight: 6.75 oz./ yd^2 per ASTM D3776, Air Permeability: 2 +2 -1 ASTM D737 Frazier, Temperature Range: 0 degrees F to 180 degrees F, NFPA 90-A, Color by Architect and selected from manufacturers standard list of colors. System shall include field adjustable balancing devices (Ductsox AFD).

2. Provide suspension hardware as follows: One Row, H-Track All-In-One with shape retaining hoops Suspension System shall include aluminum H-Track system located 1.5" above TDC (top dead center) of DuctSox system. Hardware to include 10' sections of track, snap sliders, splice connections, vertical cable supports for 8' spacing, cable clamps and end caps as required. System attachment shall be made using snap tab connector to slider spaced on 24 inch centers.
3. Manufacturer shall submit calculations and shop drawings of duct layout for each air system specified with DuctSox.

E. Underground Ducts: Shall be polyvinyl-coated steel, 18 GA, with 4 mils PVC plastic coating on the outside of the duct and 1 mil epoxy primer on the inside. See mechanical drawings for location.

F. Kitchen Hood Exhaust Duct: Ductwork shall be galvanized steel all welded construction, ASTM A240. United McGill Corp.

G. Fume Hood Exhaust Duct and Dishwasher Hood Exhaust Duct: Ductwork shall be stainless steel all welded construction, ASTM A240. United McGill Corp or equal.

H. Spiral Duct: Ductwork shall be galvanized steel with uni-seal spiral seamlock and uni-seal fittings, ASTM A653. United McGill Corp or equal. All exposed spiral duct shall be painted, color selected by Owner.

I. Round Duct on Roof: Ductwork shall be double wall insulated galvanized steel with solid welded seam longitudinal seam-K27. United McGill Corp or equal.

J. Bonding Adhesive: Durodyne WBG, Scotchgrip Adhesive 4230 or equal.

K. Duct Mastic: Minnesota Mining and Manufacturing Duct Sealer 800, Tuff-Bond No. 12, Glencoat Seal-Flex or equal.

L. Duct Joints:
1. As an option to joints and seams designated by SMACNA or shown on Drawings, the following systems may be used:
   a. Ducts with sides 24 inches to 48 inches, transverse duct joint system by Ductmate Jr., Nexus or equal (SMACNA "E" Type connection).
   b. Ducts 48 inches and larger, Ductmate Regular, Nexus (SMACNA "J" Type connection) or equal.

M. Fiber Tape: Mineral impregnated fiber tape and plastic activator-adhesive. Hardcast, Inc., United McGill Uni-Cast or equal.

N. Evaporative Cooler Duct: Ductwork shall be double wall insulated galvanized steel exterior and aluminum or stainless steel interior glass fiber insulation. 1.5 lb./cu. ft. density, 2" thick minimum, R-8. Thermal conductivity shall not exceed 0.13 Btu/ hr. sq. ft.-degrees F at a mean temperature of 75 degrees F. CSG Insulation Corp., Manville, Owens-Corning, Knauf or equal. Duct dimensions shown on drawings for double wall duct are clear (net) opening inside.

2.2 AIR TERMINALS AND DUCT FITTINGS

A. Grilles: (Grilles, Registers and Diffusers)
1. Information on Drawings: Refer to the Air Distribution Schedule on the drawings for the list of grilles. Manufacturer's model numbers are listed to complete the description. Equivalent models of J & J, Krueger, Barber-Colman, Anemostat, Price, Titus or equal.

Refer to the floor plans for neck size, CFM, air diffusion pattern, and fire damper, if required.

2. Performance: If, according to the certified data of the manufacturer of the proposed units, the sizes indicated on the drawings will not perform satisfactorily, the units shall be re-selected by the Contractor for the proper diffusion, spread, drop, and throw.
3. Frame and Accessories: All supply, return, and exhaust grilles shall be provided with cushion heads and attachments to structure, unless otherwise noted. All surface mounted grilles shall have a perimeter gasket and flanged edge. All grilles shall have frames suitable for mounting in the surfaces designated by the architectural drawing, coordinate prior to ordering.
4. Finish: All ceilings and wall grilles shall have a paintable white finish unless otherwise noted. Interior components shall be flat black.
5. Gyms: Provide 12 Ga. wire safety cables for all overhead grilles in Gym.

B. Turning Vanes: Double wall, hollow metal, air-foil shape. Spacing in accordance with manufacturer's recommendations. Aero Dyne, HEP or equal.

C. Flexible Connection: UL listed neoprene coated 30-ounce fiberglass cloth. 3" metal, 6" fabric, 3" metal. Ventglas or equal.

D. Branch Duct Volume Damper: Volume control damper (VCD) in rectangular ducts shall be as follows: Opposed blade, 6” maximum blade width, 16-gage blade, 48” maximum length, nylon or oil impregnated bronze bearings, ½” diameter pin shaft, 16-gage channel frame, actuating rod and linkage out of air stream. VCD in round duct shall be as follows: Damper blade full height of branch and 1” less than branch width. All branch dampers shall have regulator with stamped steel handle, spring loaded shaft nut, cast body, and serrated self-locking die cast core. Regulator for horizontal ducts overhead shall be mounted on sides or bottom of ducts. Secure a 12” length of brightly colored plastic ribbon to handle for ease of location. Where rectangular or round ductwork is insulated, slit insulation to allow handle to protrude. Ventlok 641 (with 607 end bearing for round ducts).

F. Displacement Ventilation Diffusers: The perforated face diffusers shall be constructed with equalization baffles behind the operative diffuser faces for uniform, low velocity, distribution of supply air. Both the equalization baffles and faces shall be securely retained in the diffuser frames with no visible fasteners on the front or side panels. The diffuser frames shall be constructed of high strength aluminum extrusion. The operative faces shall be constructed of painted high-gauge steel. The paint shall be powder coated polyester, color selected by Architect. The diffuser shall be provided with concealed mounting brackets. Diffuser manufacturer shall provide sound and pressure drop data derived from tests in accordance with ASHRAE Standard 70-1991. Provide and install 22 gauge solid steel face duct cover with extruded aluminum frame from top of diffuser to ceiling for all exposed diffuser/ duct installations, see plans.

H. Louvers: Refer to the Air Distribution Schedule on the drawings. Manufacturer’s model numbers are listed to complete the description. Equivalent models of Ruskin, Greenheck, Dayton or approved equal. Contractor shall fabricate and provide 16 GA. galvanized perforated panel (50% Free Area) over exterior of all louvers and have field painted to match exterior wall. Refer to the floor plans for all sizes.

2.3 DUCTWORK INSULATION MATERIALS

A. General: All ductwork insulation materials shall have fire and smoke hazard ratings as tested under ASTM E-84 and UL-181 not exceeding a flame spread of 25 and smoke developed of 50.

B. Acoustic Lining: Glass fiber. One side coated to prevent fiber erosion up to 6000 ft./ min. Average noise reduction coefficient of 0.90. 0.13 Btu/ hr – sq. ft. – degrees F conductivity at a mean temperature of 75 degrees F, R-8. CSG Insulation Corp., Schuller, Owens-Corning, Knauf or equal. Duct dimensions shown on drawings for lined duct are clear (net) opening inside of lining.

C. Fiber Glass Blanket: Foil faced, 0.13 Btu/ hr – sq. ft. – degrees F conductivity at a mean temperature of 75 degrees F, R-8. CSG Insulation Corp., Schuller, Owens-Corning, Knauf or equal.

D. Bonding Adhesive: Benjamin Foster 85-15 or equal.

2.4 PIPING MATERIALS

A. Refrigerant Piping:
1. Type L hard temper seamless copper, ASTM B88. Wrought copper fittings ANSI B16.22. 50/ 50 lead-tin solder joints above grade, 95/ 5 tin-silver brazed joints below grade. Provide schedule 40 PVC sleeve pipe for all below grade refrigerant piping. All piping shall be sized per equipment manufacturer requirements.
2. Valves and Specialties:
   a. Line Valves: Bronze body, ball type, TFE locked in seals. Back seated valve stem. Contromatics C-11.
   b. Filter-Drier: Replaceable core. Capacity in accordance with ARI Standard 710. Sporlan "Catch-All".
   c. Moisture Indicator-Sight Glass: Double port. Henry, Sporlan.
   d. Vibration Isolating Connection: Seamless flexible bronze tubing, braid covered. Suitable for system pressure. American, Flexonics.

B. Refrigerant Piping (Ductless Split System Multi-Zone):
1. Type ACR soft temper seamless copper, ASTM B280. Cast copper alloy fittings for flared copper tubes, ASME B16.26. Follow the Society of Automotive Engineers SAE J533 Standard-Flares for tubing. All piping shall be sized per equipment manufacturer requirements.
2. Valves and Specialties:
   a. Line Valves: Bronze body, ball type, TFE locked in seals. Back seated valve stem. Contromatics C-11.
   b. Filter-Drier: Replaceable core. Capacity in accordance with ARI Standard 710. Sporlan "Catch-All".
   c. Moisture Indicator-Sight Glass: Double port. Henry, Sporlan.
   d. Vibration Isolating Connection: Seamless flexible bronze tubing, braid covered. Suitable for system pressure. American, Flexonics.

C. Miscellaneous Piping Items:
1. Pipe Support:
   a. Pipe Hanger: Adjustable split ring, swivel hanger and rod. Black malleable iron. Size and maximum loads per manufacturer's recommendation. Felt Lined, Kin-Line 450 F.
   b. Construction Channel: 12 gage 1-5/8" x 1-5/8" steel channel. Single or multiple sections. Self-locking nuts and fittings. Kin-Line, Unistrut.
2. Pipe Sleeves: 24 gage galvanized steel. Adjus-to-Crete #10 with #99 thimble for floors. #100 for walls.

D. Flashing: Flashing for piping through roof shall be prefabricated 24 gage galvanized steel roof jacks with 8" square flange around pipe. Seal with weatherproofing mastic.

2.5 PIPING INSULATION MATERIALS

A. General: All piping insulation materials shall have fire and smoke hazard ratings as tested under ASTM E-84 and UL 723 not exceeding a flame spread of 25 and smoke developed of 50.

B. Refrigerant Piping: Rubber based elastomeric preformed pipe insulation. Thermal conductivity shall not exceed 0.25 Btu-in/hr-SF-degree F at mean temperature of 75 degrees F., 3/4" thick. Provide aluminum pipe and fitting jacketing. 0.016" thickness for straight pipe, 0.024" thickness for fittings with integral moisture barrier, pre-fabricated strapping and seals for piping exposed to weather, Childers, Pabco or equal.
   1. Insulation shall be provided on both refrigerant lines for ductless split systems.

2.6 EQUIPMENT

A. General Requirements:
   1. Capacity: Capacities shall be in accordance with schedules shown on drawings. Capacities are to be considered minimum.
   2. Dimensions: Equipment must conform to space requirements and limitations as indicated on drawings and as required for operation and maintenance. Where Architectural screening is indicated, equipment shall not extend above or beyond screening. Equipment will not be accepted that does not readily conform to space conditions. Prepare and submit layout drawings for all proposed equipment (different than scheduled units) showing actual job conditions, required clearances for proper operation, maintenance, etc.
   3. Ratings:
      a. Gas: Gas burning equipment shall be furnished with 100% safety gas shut-off, intermittent pilot ignition, and be CSA (US) certified, except that boilers shall be CSA (US) certified or UL listed.
      b. Electrical: Electrical equipment shall be in accordance with NEMA Standards and UL or ETL listed where applicable standards have been established.
   4. Piping: Each item or assembly of items shall be furnished completely piped for connection to services. Control valves and devices shall be provided. Equipment requiring domestic water for non-potable use shall be provided with backflow preventer acceptable for intended use by local governing authorities.
   5. Electrical:
      a. General: Each item or assembly of items shall be furnished completely wired to individual terminal blocks for connection to single branch electrical circuit. All electrical accessories and controls required by equipment shall be furnished. Provide terminal blocks for controls and interlocks not included in equipment package. Manual and magnetic starters shall have ambient compensating running overcurrent protection in all ungrounded conductors. Magnetic starters shall be manual reset, shall have H-O-A switches and auxiliary contacts. Controllers and other devices shall be in NEMA 1 or 3R enclosures as applicable.
      b. Wiring: Conductors, conduit, and wiring shall be in accordance with Electrical Specifications. Individual items within assembly shall be separately protected with dead front, fused disconnect, fuse block, or circuit breaker for each ungrounded conductor, all accessible on operating side of equipment. Switches, contacts, and other devices shall be in ungrounded conductors.
      c. Motors: Shall be rated, constructed, and applied in accordance with NEMA and ANSI Standards without using service factor. Single-phase motor shall be of type to suit application. Three-phase motors shall be open drip proof, NEMA B design on pumps and fans, NEMA C on reciprocating equipment, sealed ball bearing, three-phase induction unless otherwise noted. Design shall limit starting inrush current and running current to values shown on drawings. Motors 1 horsepower and larger shall be the premium efficiency type, tested according to IEEE Standard 112, Method B. Motors exposed to weather shall be TEFC. Motors in a fan air stream shall be TEFC or TEAO. Vertical motors outdoors shall be ODP or TEFC

and shall have rain caps.

d. Starters: Motor starters shall be furnished for all equipment except where starter is in a motor control center as designated on the electrical drawings. Deliver starter to Electrical Contractor for installation and wiring.
e. Control Voltage: Equipment connected to greater than 240 volts shall be provided with 120 volt control circuit from integral protected transformer if separate source is not indicated on plans. 240 volt control is acceptable if confined within control panel.
f. Submittals: Included in shop drawings shall be internal wiring diagrams and manufacturer's recommend external wiring.

6. Fan Selection:
   a. Fan Curves: Performance curves shall be submitted for all units of 3000 CFM or greater. Operating point for forward curved fans shall be from point of maximum efficiency towards increased CFM limited by horsepower scheduled. Operating point for backward inclined fans shall be selected near point of maximum efficiency. Curves shall plot CFM verses static pressure with constant brake horsepower, RPM, and efficiency lines.
   b. Static Pressure: Unless otherwise noted, pressure scheduled as external static pressure (ESP) includes all ductwork and accessory losses external to the unit housing. Unless otherwise noted, pressure scheduled as total static pressure includes all ductwork, filter, coil, cabinet, damper, and other accessory losses. Unless otherwise noted, pressure scheduled as duct static pressure includes all supply and return ductwork and accessory losses external to the unit housing and plenum (as applicable). The allowance for filter losses is 0.3" WC, unless otherwise noted. Submit itemized static pressure losses for all components.
7. Filters:
   a. General: Tested and rated in accordance with ASHRAE Standard 52.2 and Title 24, C.C.R. Furnish and install one complete change of all filters after air balance in completed and prior to acceptance. Provide pressure differential gage across all filter banks.
   b. Filter Media: 2" media. MERV 13. Clean filter resistance 0.25" water at 500 fpm. Throw-away frame. Class 2. Camfil Farr AP.
   c. Pressure Differential Gage: Diaphragm actuated. 4" dial. Zero adjustment. Accuracy +/ - 2% of full scale. Range as required. Provide static pressure sensors, tubing, and mounting brackets. Dwyer Series 2000. Mark gage to indicate filter replacement pressure, coordinate point with filter and equipment manufacturers.
8. Mixing Dampers: Opposed blade, 16-gage. Six-inch maximum blade width, 48" maximum length. Nylon or oil impregnated bronze bearings. One-half inch diameter pin shaft. 16- gage channel frame. One percent maximum leakage at 4" WC in accordance with AMCA 500 for outside air dampers. Actuating rod out of air stream. Arrow.
9. Sound Ratings: Shall be in accordance with ASHRAE 36-72. Sound ratings shall not exceed scheduled values.
10. Drives: Unless noted as direct connected, drives shall be V-belt, rated at 150% of motor horsepower. Multiple drive belts shall be matched set. Drive sheaves shall be dynamically balanced, adjustable, range +/ - 10%, selected at mid-range. Adjustable relative movement shall be lockable to shaft. Belts shall be aligned within 1-1/2 degrees at all times. Open drives shall be provided with OSHA approved open mesh belt guards. Belt guards exposed to weather shall be weatherproof enclosure with louvered face for adequate ventilation. Driving motor shall be mounted on adjustable rails. T.B. Woods, Browning. Submit RPM range of driven machine with drive selection.

B. Air Conditioning Unit (thru 15 tons):
1. General: Self-contained heating/cooling unit designed for outdoor installation. Factory assembled and tested. Provide all starters and relays required for operation. 24 volt

control circuit from integral transformer. Weatherproof cabinet, galvanized steel with enamel finish. Drain pan. Multi-vane, centrifugal supply fan. ARI certified. Gas equipment AGA certified. BDP, Carrier, York, Trane, Lennox, and Daikin.

2. Refrigeration: Sealed Hermetic compressor with heater, high/ low pressure switch, recycling timer. Air-cooled condenser with propeller fan. Non-ferrous finned coil. Low ambient control to 45 degrees F, unless otherwise noted.
3. Heat: Gas fired. Aluminized or ceramic-coated welded steel heat exchanger. Electric ignition. Automatic gas valve, 100% safety shutoff.
4. Economizer with Power Exhaust: Economizer shall be a modulating power exhaust type where the unit will exhaust at the minimum outside air setpoint and exhaust 100% during economizer mode. Economizer with power exhaust is shipped separately and shall be field installed and wired under this section.
   a. Provide plastic air sampling tube to sense pressure in room for control of power exhaust. Tube shall be placed thru ceiling with escutcheon plate in room that unit serves.
   b. Modulating Economizer Sequence of Operation: The economizer system initially responds to a signal from the cooling thermostat and functions as a true first stage for cooling, while providing maximum fuel economy. The economizer is automatically locked out during the heating mode and holds the outdoor air damper at the minimum position settings. During the occupied period, the discharge sensor provides a signal to the actuator during free cooling or economizer mode. The signal opens the economizer damper until the discharge temperature drops below 50 degrees F. At this time, the signal causes the motor to drive the damper back to minimum position. As the discharge temperature climbs to 60 degrees F the motor will drive back open. During the occupied period, the actuator will not close past the minimum position. **(The setpoints maybe changed by Commissioning Contractor to optimize controls for LEED Certification or Title 24 Requirements.)** If the fully open actuator cannot satisfy the space demand, mechanical cooling is sequenced on. During the unoccupied period, the actuator will override minimum position setting and drive fully closed. On a loss of power, the actuator will spring return fully closed. When in heating operation, or when outdoor air temperature or enthalpy conditions are high, economizer operation is locked out, and actuator is held at minimum position. The staging relay is used when the first stage compressors must provide mechanical cooling when assisting the economizer. The staging relay can be omitted when the second stage compressors can be used to assist the economizer with mechanical cooling.
   c. CO2 Sensor Economizer Integration: When a CO2 sensor is used in conjunction with an economizer, the minimum position jumper between P and P1 on the logic is removed, and the sensor connected. When the CO2 sensor gets a reading higher than the setpoint, the sensor will signal the logic to modulate the o/a dampers open. The HVAC unit functions as if there is no economizer during the CO2 call for fresh air. When the CO2 level falls below the setpoint, the damper modulates back to the minimum position.
   d. Modulating Power Exhaust Sequence of Operation: When the outside air damper on an economizer starts to open, extra air is introduced the system. As this happens, a mercury switch mounted on the economizer closes. This causes a switch to close on the variable speed controller, allowing high voltage power to be sent to an exhaust motor and blower. The mercury switch is adjusted to close at the 1% outside air damper position. The power exhaust is a centrifugal blower power exhaust. The power exhaust uses an adjustable transducer (0-10 VDC) to accurately compare the space pressure to atmospheric pressure and adjust the amount of exhaust air accordingly. The exhaust volume adjustment is accomplished using a variable frequency drive with a built-in PID control to maintain a field adjustable pressure set point.

OR

5. Economizer: Economizer shall be a modulating gear driven type where the outside air will modulate from closed to minimum outside air setpoint and 100% during economizer mode. Economizer is shipped separately and shall be field installed and wired under this section.
6. Guarantee: Provide 5 year extended parts warranty on the condenser coil and compressor.

C. Split System Air Conditioning:
1. Indoor Unit: The indoor unit shall be completely factory assembled and wired. The casing shall have a white finish. The evaporator fan shall be a high performance, forward curve line flow fan direct driven by a single motor. The fan shall be statically and dynamically balanced and run on permanently lubricated bearings. A manually adjustable change vane shall be provided. The vane shall have the ability to direct the air from horizontal to vertical. An adjustable guide vane shall be provided to manually change the air direction from left to right. The evaporator coil shall be of nonferrous construction with smooth plate fins bonded to copper tubing. The tubing shall have inner grooves for high efficiency heat exchange. All tube joints shall be brazed with phoscopper or silver alloy. The coils shall be pressure-tested at the factory. A condensate pan with drain shall be provided under the coil.
2. Outdoor Unit: The outdoor unit shall be completely factory assembled, piped, and wired. The casing shall be fabricated of galvanized steel, bonderized and finished with baked enamel. The unit shall be furnished with a direct drive, propeller type fan arranged for horizontal discharge. The motor shall have inherent protection, be of the permanently lubricated type and resiliently mounted for quiet operation. The fan shall be provided with a raised guard to prevent contact with moving parts. The compressor shall be of the high-performance rotary type with accumulator and internal thermal overloads. The compressor shall be mounted so as to avoid the transmission of vibration. The refrigeration system shall have the capability to operate with a maximum height difference of 25 feet and overall refrigerant tubing length of 49 feet between indoor and outdoor sections without the need for line size changes, traps, or additional oil. Refrigerant flow from the condenser to be controlled by means of a capillary tube. The condenser coil shall be of nonferrous construction with smooth plate fins bonded to copper tubing. The coil shall be protected with and integral metal guard. The unit shall be controlled by the microprocessor located in the matching indoor unit.
3. Furnace: (with evaporative coolers use 409 stainless steel)
   a. General: Self-contained unit designed for indoor installation. Factory assembled and tested. Provide all starters and relays required for operation. 24 volt control circuit from integral transformer. Steel cabinet with interlocking joint construction. High/ Low pressure switches. AGA approved.
   b. Heat: Aluminized steel heat exchanger. Electric ignition. Automatic gas valve, 100% high heat safety shutoff.

OR

D. Split System Air Conditioning:
1. Condensing Unit:
   a. General: Self-contained unit designated for outdoor installation. Factory assembled and tested. Provide all starters and relays required for operation. 24 volt control circuit from integral transformer. Weatherproof cabinet, galvanized steel with enamel finish. Drain pan. ARI certified. Quietside, Carrier, York, Trane, and Lennox.
   b. Refrigeration: Sealed Hermetic compressor with internal vibration isolating mount. Crank case heater, high/low pressure switch, anti-recycle timer. Air-cooled

condenser with propeller fan. Non-ferrous finned coil. Low ambient control to 25°F, unless otherwise noted.

c. Guarantee: Provide 5 year extended warranty on the condenser coil and compressor.

2. Furnace: Aluminized steel heat exchanger, sealed combustion forced draft gas fired with fan and limit switch, silent gas valves, electric intermittent ignition, AGA approved, multi-speed direct drive blower on vibration mountings, filters, capacity as scheduled on plans. Twin furnace with twinning control kit. Quietside, Carrier, York, Trane, and Lennox.

3. Coil Section: Encased coil. Casing shall be galvanized steel finished with baked enamel and shall be insulated. Direct expansion evaporation coils suitable for use with upflow furnace complete with distribution piping, expansion valve, drain pan, and drain connection. Quietside, Carrier, York, Trane, and Lennox.

OR

E. Ductless Split System Air Conditioning:

1. Condensing Unit:

a. General: Self-contained unit designated for outdoor installation. Factory assembled and tested. Provide all starters and relays required for operation. 24 volt control circuit from integral transformer. Weatherproof cabinet, galvanized steel with enamel finish. Drain pan. ARI certified. Provide 3/4" x 18 GA. expanded metal coil guards. Daikin, Quietside, Carrier, York, Trane, and Mitsubishi.

b. Refrigeration: Sealed Hermetic compressor with internal vibration isolating mount. Crank case heater, high/low pressure switch, anti-recycle timer. Air-cooled condenser with propeller fan. Non-ferrous finned coil. Low ambient control to 25°F, unless otherwise noted.

c. Guarantee: Provide 5 year extended warranty on the condenser coil and compressor.

2. Indoor Unit: Multi-speed direct drive blower on vibration mountings, filters, capacity as scheduled on plans. Daikin, Quietside, Carrier, York, Trane, and Mitsubishi.

3. Coil Section: Encased coil. Casing shall be galvanized steel finished with baked enamel. Direct expansion evaporation coils complete with distribution piping, expansion valve, drain pan, and drain connection. Daikin, Quietside, Carrier, York, Trane, and Mitsubishi.

OR

F. Split System Air Conditioning (VRV System):

1. System Description:

a. The variable capacity, heat recovery air conditioning system shall be a Daikin Variable Refrigerant Volume Series (heat and cool model) split system is basis of design. LG, Trane, or Mitsubishi shall be acceptable with similar performance. The system shall consist of multiple evaporators, branch selector boxes, REFNET™ joints and headers, a three pipe refrigeration distribution system using PID control and Daikin VRV® condenser unit. The condenser shall be a direct expansion (DX), air-cooled heat recovery, multi-zone air-conditioning system with variable speed inverter driven compressors using R-410A refrigerant. The condensing unit may connect an indoor evaporator capacity up to 200% of the condensing unit capacity. All zones are each capable of operating separately with individual temperature control. A dedicated hot gas pipe may be required to ensure optimum heating operation performance.

b. The Daikin condensing unit shall be interconnected to indoor unit models FXFQ, FXHQ, FXMQ, FXLQ, FXNQ, FXTQ, FXDQ, FXZQ, FXAQ, FXMQ_MF and FXUQ

and shall range in capacity from 7,500 Btu/h to 96,000 Btu/h in accordance with Daikin's engineering data book detailing each available indoor unit. The indoor units shall be connected to the condensing unit utilizing Daikin's REFNET™ specified piping joints and headers to ensure correct refrigerant flow and balancing. T style joints are not acceptable for a variable refrigerant system.

c. Operation of the system shall permit either individual cooling or heating of each indoor unit simultaneously or all of the indoor units associated with each branch of the cool/heat selector box (BSQ_T / BS_Q54T). Each indoor unit or group of indoor units shall be able to provide set temperature independently via a local remote controller, an Intelligent Controller, an Intelligent Manager or a BMS interface.

d. Branch selector boxes shall be located as shown on the drawing. The branch selector boxes shall have the capacity to control up to 290 MBH (cooling) downstream of the branch selector box. Each branch of the branch selector box shall consist of three electronic expansion valves, refrigerant control piping and electronics to facilitate communications between the box and main processor and between the box and indoor units. The branch selector box shall control the operational mode of the subordinate indoor units. The use of three EEV's ensures continuous heating during defrost (multiple condenser systems), no heating impact during changeover and reduced sound levels. The use of solenoid valves for changeover and pressure equalization shall not be acceptable due to refrigerant noise.

2. VRV IV Features and Benefits:
   a. Voltage Platform: Heat recovery condensing units shall be available with a 208-230V/3/60 power supply.
   b. Advanced Zoning: A single system shall provide for up to 64 zones.
   c. Independent Control: Each indoor unit shall use a dedicated electronic expansion valve with 2000 positions for independent control.
   d. VFD Inverter Control and Variable Refrigerant Temperature: Each condensing unit shall use high efficiency, variable speed all "inverter" compressor(s) coupled with inverter fan motors to optimize part load performance. The system capacity and refrigerant temperatures shall be modulated automatically to set suction and condensing pressures while varying the refrigerant volume for the needs of the cooling or heating loads. The control will be automatic and customizable depending on load and weather conditions. Indoor units shall use PID to control superheat to deliver a comfortable room temperature condition and optimize efficiency.
   e. Configurator Software: Each system shall be available with configurator software package to allow for remote configuration of operational settings and also for assessment of operational data and error codes. If this software is not provided by an alternate manufacturer, for each individual outdoor unit the contractor shall do the settings manually and keep detailed records for future maintenance purposes.
   f. Auto-Charging: Each system shall have a refrigerant auto-charging function.
   g. Defrost Heating: Multiple condenser VRV systems shall maintain continuous heating during defrost operation. Reverse cycle (cooling mode) defrost operation shall not be permitted due to the potential reduction in space temperature.
   h. Oil Return Heating: Multiple condenser VRV systems shall maintain continuous heating during oil return operation. Reverse cycle (cooling mode) oil return during heating operation shall not be permitted due to the potential reduction in space temperature.
   i. Low Ambient Cooling: Each system shall be capable of low ambient cooling operation to -4°F DB.
   j. Independent Control: Each indoor unit shall use a dedicated electronic expansion valve for independent control.
   k. Flexible Design:
      1) Systems shall be capable of up to 540ft (623ft equivalent) of linear piping between the condensing unit and furthest located indoor unit.

2) Systems shall be capable of up to 3,280ft total “one-way” piping in the piping network.
3) Systems shall have a vertical (height) separation of up to 295ft between the condensing unit and the indoor units.
4) Systems shall be capable of up to 295ft from the first REFNET™ / branch point.
5) The condensing unit shall have the ability to connect an indoor unit evaporator capacity of up to 200% of the condensing unit capacity.
6) Systems shall be capable of 98ft vertical separation between indoor units.
7) Condensing units shall be supported with a fan motor ESP up to 0.32”. WG as standard to allow connection of discharge ductwork and to prevent discharge air short circuiting.

l. Oil Return: Each system shall be furnished with a centrifugal oil separator and active oil recovery cycle.
m. Simple Wiring: Systems shall use 16/18 AWG, 2 wire, multi-stranded, non-shielded and non-polarized daisy chain control wiring.
n. Outside Air: Systems shall provide outside air capability.
o. Space Saving: Each system shall have a condensing unit module footprint as small as 36-5/8’’ x 30-1/8’’.
p. Advanced Diagnostics: Systems shall include a self-diagnostic, auto-check function to detect a malfunction and display the type and location.
q. Each condensing unit shall incorporate contacts for electrical demand shedding with optional 3 stage demand control with 12 customizable demand settings.
r. Advanced Controls: Each system shall have at least one remote controller capable of controlling up to 16 indoor units.
s. Each system shall be capable of integrating with open protocol BACnet and LonWorks building management systems.
t. Low Sound Levels: Each system shall use indoor and condensing units with quiet operation as low as 27 dB(A).

3. Quality Assurance:
a. The units shall be tested by a Nationally Recognized Testing Laboratory (NRTL), in accordance with ANSI/UL 1995 – Heating and Cooling Equipment and bear the Listed Mark.
b. All wiring shall be in accordance with the California Electric Code (CEC).
c. The system will be produced in an ISO 9001 and ISO 14001 facility, which are standards set by the International Standard Organization (ISO). The system shall be factory tested for safety and function.
d. The condensing unit will be factory charged with R-410A.

4. Delivery, Storage and Handling:
a. Unit shall be stored and handled according to the manufacturer’s recommendations.

5. Standard Limited Warranty:
a. Daikin North America LLC warrants original owner of the non-residential building in which the Daikin products are installed that under normal use and maintenance for comfort cooling and conditioning applications such products (the “Products”) will be free from defects in material and workmanship. This warranty applies to compressor and all parts and is limited in duration to ten (10) years starting from the ‘’installation date’’ which is one of the two dates below:
1) The installation date is the date that the unit is originally commissioned, but no later than 18 months after the manufacture date noted on the unit’s rating plate.
2) If the date the unit is originally commissioned cannot be verified, the installation date is three months after the manufacture date.

6. Operating Range:
a. The operating range in cooling or cooling dominant simultaneous cooling/heating will be (-4°F) 23°F DB ~ 122°F DB.

b. Each system as standard shall be capable of onsite reprogramming to allow low ambient cooling operation down to -4°F DB.
c. The operating range in heating or heating dominant simultaneous cooling/heating will be -13°F WB – 60°F WB.

7. Refrigerant Piping: The system shall be capable of refrigerant piping up to 540 actual feet or 623 equivalent feet from the condensing unit to the furthest indoor unit, a total combined liquid line length of 3,280 feet of piping between the condensing and indoor units with 295 feet maximum vertical difference, without any oil traps. REFNET™ piping joints and headers shall be used to ensure proper refrigerant balance and flow for optimum system capacity and performance. T style joints shall not be acceptable as this will negatively impact proper refrigerant balance and flow for optimum system capacity and performance.
8. Design Basis: The HVAC equipment basis of design is Daikin North America. All bidders shall furnish the minimum system standards as defined by the base bid model numbers, model families or as otherwise specified herein. In any event, the contractor shall be responsible for all specified items and intents of this document without further compensation. Equal products of Trane, LG, or Mitsubishi are acceptable.
9. Condensing Unit:
   a. General: The condensing unit is designed specifically for use with VRV IV series components.
      1) The condensing unit shall be factory assembled in the USA and pre-wired with all necessary electronic and refrigerant controls. The refrigeration circuit of the condensing unit shall consist of Daikin inverter scroll compressors, motors, fans, condenser coil, electronic expansion valves, solenoid valves, 4-way valve, distribution headers, capillaries, filters, shut off valves, oil separators, service ports, liquid receiver, and suction accumulator. High/low pressure gas line, liquid and suction lines must be individually insulated between the condensing and indoor units.
      2) The condensing unit can be wired and piped with access from the left, right, rear or bottom.
      3) The connection ratio of indoor units to condensing unit shall be permitted up to 200%.
      4) Each condensing system shall be able to support the connection of up to 64 indoor units dependent on the model of the condensing unit.
      5) The sound pressure level standard shall be that value as listed in the Daikin engineering manual for the specified models at 3 feet from the front of the unit. The condensing unit shall be capable of operating automatically at further reduced noise during nighttime or via an external input.
      6) The system will automatically restart operation after a power failure and will not cause any settings to be lost, thus eliminating the need for reprogramming.
      7) The unit shall incorporate an auto-charging feature. Manual changing should be support with a minimum of 2 hours of system operation data to ensure correct operation.
      8) The condensing unit shall be modular in design and should allow for side-by-side installation with minimum spacing.
      9) The following safety devices shall be included on the condensing unit, high pressure sensor and switch, low pressure sensor, control circuit fuses, crankcase heaters, fusible plug, overload relay, inverter overload protector, thermal protectors for compressor and fan motors, over current protection for the inverter and anti-recycling timers.
      10) To ensure the liquid refrigerant does not flash when supplying to the various indoor units, the circuit shall be provided with a sub-cooling feature.
      11) Oil recovery cycle shall be automatic occurring 2 hours after start of operation and then every 8 hours of operation. Each system shall maintain continuous heating during oil return operation.

12) The condensing unit shall be capable of heating operation at -13°F wet bulb ambient temperature without additional low ambient controls or an auxiliary heat source.
13) The multiple condenser VRV systems shall continue to provide heat to the indoor units in heating operation while in the defrost mode.

b. Unit Cabinet:
1) The condensing unit shall be completely weatherproof and corrosion resistant. The unit shall be constructed from rust-proofed mild steel panels coated with a baked enamel finish.

c. Fan:
1) The condensing unit shall consist of one or more propeller type, direct-drive 350 or 750W fan motors that have multiple speed operation via a DC (digitally commutating) inverter.
2) The condensing unit fan motor shall have multiple speed operation of the DC (digitally commutating) inverter type, and be of high external static pressure and shall be factory set as standard at 0.12 in. WG. A field setting switch to a maximum 0.32 in. WG pressure is available to accommodate field applied duct for indoor mounting of condensing units.
3) The fan shall be a vertical discharge configuration with a nominal airflow maximum range of 5,544 CFM to 24,684 CFM dependent on model specified.
4) Nominal sound pressure levels shall be as shown below.

Model Number	Sound Pressure Level dB(A)
REYQ72TTJU	58
REYQ96TTJU	61
REYQ120TTJU	61
REYQ144TTJU	65
REYQ168TTJU	65
REYQ192TTJU	63
REYQ216TTJU	64
REYQ240TTJU	66
REYQ264TTJU	66
REYQ288TTJU	68
REYQ312TTJU	68
REYQ336TTJU	68
REYQ360TTJU	66
REYQ384TTJU	68
REYQ408TTJU	69
REYQ432TTJU	70
REYQ456TTJU	70

5) The fan motor shall have inherent protection and permanently lubricated bearings and be mounted.
6) The fan motor shall be provided with a fan guard to prevent contact with moving parts.
7) Night setback control of the fan motor for low noise operation by way of automatically limiting the maximum speed shall be a standard feature. Operation sound level shall be selectable from 3 steps as shown below.

Operation Sound dB(A)	Night Mode Sound Pressure Level dB(A)
Step 1 max.	55
Step 2 max.	50

Step 3 max.	45

d. Condenser Coil:
   1) The condenser coil shall be manufactured from copper tubes expanded into aluminum fins to form a mechanical bond.
   2) The heat exchanger coil shall be of a waffle louver fin and rifled bore tube design to ensure high efficiency performance.
   3) The heat exchanger on the condensing units shall be manufactured from Hi-X seamless copper tube with N-shape internal grooves mechanically bonded on to aluminum fins to an e-Pass Design.
   4) The fins are to be covered with an anti-corrosion Ulta Gold coating as standard with a salt spray test rating of 1000hr (ASTM B117 & Blister Rating:10), Acetic acid salt spray test: 500hr (ASTM G85 & Blister Rating:10).
   5) The pipe plates shall be treated with powdered polyester resin for corrosion prevention. The thickness of the coating must be between 2.0 to 3.0 microns.
   6) The outdoor coil shall have three-circuit heat exchanger design eliminating the need for bottom plate heater. The lower part of the coil shall be used for inverter cooling and be on or off during heating operation enhancing the defrost operation.
   7) The condensing unit shall be factory equipped with condenser coil guards on all sides.

e. Compressor:
   1) The Daikin inverter scroll compressors shall be variable speed (PVM inverter) controlled which is capable of changing the speed to follow the variations in total cooling and heating load as determined by the suction gas pressure as measured in the condensing unit. In addition, samplings of evaporator and condenser temperatures shall be made so that the high/low pressures detected are read every 20 seconds and calculated. With each reading, the compressor capacity (INV frequency) shall be controlled to eliminate deviation from target value. Non inverter-driven compressors, which may cause starting motor current to exceed the nominal motor current (RLA) and require larger wire sizing, shall not be allowed.
   2) The inverter driven compressor in each condensing unit shall be of highly efficient reluctance DC (digitally commutating), hermetically sealed scroll “G-type” or “J-type”.
   3) Neodymium magnets shall be adopted in the rotor construction to yield a higher torque and efficiency in the compressor instead of the normal ferrite magnet type. At complete stop of the compressor, the neodymium magnets will position the rotor into the optimum position for a low torque start.
   4) The capacity control range shall be as low as 3% to 100%.
   5) The compressors’ motors shall have a cooling system using discharge gas, to avoid sudden changes in temperature resulting in significant stresses on winding and bearings.
   6) Each compressor shall be equipped with a crankcase heater, high pressure safety switch, and internal thermal overload protector.
   7) Oil separators shall be standard with the equipment together with an intelligent oil management system.
   8) The compressor shall be spring mounted to avoid the transmission of vibration eliminating the standard need for spring isolation.
   9) In the event of compressor failure, the remaining compressors shall continue to operate and provide heating or cooling as required at a proportionally reduced capacity. The microprocessor and associated controls shall be designed to specifically address this condition.
   10) In the case of multiple condenser modules, conjoined operation hours of the compressors shall be balanced by means of the Duty Cycling Function,

ensuring sequential starting of each module at each start/stop cycle, completion of oil return, completion of defrost or every 8 hours and extending the operating life of the system. When connected to a central control system, sequential start is activated for all system on each DIII network.

f. Electrical:
   1) The power supply to the condensing unit shall be 208-230 volts, 3 phase, 60 hertz +/- 10%.
   2) The control voltage between the indoor and condensing unit shall be 16VDC non-shielded, stranded 2 conductor cable.
   3) The control wiring shall be a two-wire multiplex transmission system, making it possible to connect multiple indoor units to one condensing unit with one 2-cable wire, thus simplifying the wiring installation.

10. BS (4/6/8/10/12) Q_T Branch Selector Box for VRV IV Heat Recovery System:
   a. General: The BSQ36TVJ, BSQ60TVJ, BSQ96TVJ, BS4Q54TVJ, BS6Q54TVJ, BS8Q54TVJ, BS10Q54TVJ and BS12Q54TVJ branch selector boxes are designed specifically for use with VRV IV series heat recovery system components.
      1) These selector boxes shall be factory assembled, wired, and piped.
      2) These BSQ_T / BS (4/6/8/10/12) Q54T branch controllers must be run tested at the factory.
      3) These selector boxes must be mounted indoors.
      4) When simultaneously heating and cooling, the units in heating mode shall energize their subcooling electronic expansion valve.
   b. Unit Cabinet:
      1) These units shall have a galvanized steel plate casing.
      2) Each cabinet shall house 3 electronic expansion valves for refrigerant control per branch.
      3) The cabinet shall contain one subcooling heat exchanger per branch.
      4) The unit shall have sound absorption thermal insulation material made of flame and heat resistant foamed polyethylene.
      5) Nominal sound pressure levels must be measured and published on the submittals by the manufacturer. These sound levels must not exceed the values below.

Model Number	Sound Level dB(A) Operating	Sound Level dB(A) Max
BSQ36TVJ	42	32
BSQ60TVJ	43	32
BSQ96TVJ	44	34
BS4Q54TVJ	38	45
BS6Q54TVJ	39	47
BS8Q54TVJ	39	47
BS10Q54TVJ	40	48
BS12Q54TVJ	40	48

   c. Dimensions:
      1) Each BSQ_T unit shall be no larger than 8-1/8” x 15-1/4” x 12-13/16”.
      2) Each BS4Q_T shall be no larger than 11-3/4” x 14-9/16” x 18-15/16”.
      3) Each BS(6/8)Q_T shall be no larger than 11-3/4” x 22-13/16” x 18-15/16”.
      4) Each BS(10/12)Q_T shall be no larger than 11-3/4” x 32-5/16” x 18-15/16”.
   d. Refrigerant Valves:
      1) The unit shall be furnished with 3 electronic expansion valves per branch to control the direction of refrigerant flow. The use of solenoid valves for changeover and pressure equalization shall not be acceptable due to refrigerant noise.
      2) The refrigerant connections must be of the braze type.

3) In multi-port units, each port shall have its own electronic expansion valves. If common expansion/solenoid valves are used, redundancy must be provided.
4) Each circuit shall have at least one (36,000 Btu/h indoor unit or smaller for the BSQ36TVJ, 54,000 Btu/h indoor unit or smaller for the BS (4/6/8/10/12) Q54TVJ, 60,000 Btu/h indoor unit or smaller for the BSQ60TVJ and 96,000 Btu/h indoor unit or smaller for the BSQ96TVJ) branch selector box.
5) Multiple indoor units may be connected to a branch selector box with the use of a REFNET™ joint provided they are within the capacity range of the branch selector.

e. Condensate Removal: The unit shall not require provisions for condensate removal. A safety device or secondary drain pan shall be installed by the mechanical contractor to comply with the applicable mechanical code if an alternate manufacturer is selected.
f. Electrical:
1) The unit electrical power shall be 208/230 volts, 1 phase, 60 hertz.
2) The unit shall be capable of operation within the limits of 187 volts to 255 volts.
3) The minimum circuit amps (MCA) shall be 0.1 and the maximum overcurrent protection amps (MOP) shall be 15.
4) The control voltage between the indoor and condensing unit shall be 16VDC non-shielded 2 conductor cable.

11. FXFQ_T – Round Flow Sensing Ceiling Cassette Unit:
a. General: Daikin indoor unit model FXFQ_T shall be a round flow ceiling cassette fan coil unit, operable with R-410A refrigerant, equipped with an electronic expansion valve, direct drive DC (ECM) type fan, for installation into the ceiling cavity equipped with an air panel grill. It shall be available in capacities from 7,500 Btu/h to 48,000 Btu/h. Model numbers are FXFQ07TVJU, FXFQ09TVJU, FXFQ12TVJU, FXFQ15TVJU, FXFQ18TVJU, FXFQ24TVJU, FXFQ30TVJU, FXFQ36TVJU, FXFQ48TVJU to be connected to outdoor unit model RXYQ/ RXYMQ/ RWEYQ heat pump and REYQ/ RWEYQ heat recovery model. It shall be a round flow air distribution type, fresh white, impact resistant decoration panel, or optional self-cleaning filter panel. The supply air is distributed via four individually motorized louvers. To save energy and optimize occupancy comfort, the indoor unit shall be equipped with built in occupancy sensor and surface temperature sensor. Computerized PID control shall be used to control superheat to deliver a comfortable room temperature condition. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature when used with Daikin remote control BRC1E72, BRC1E73, BRC2A71 and BRC1E52B7. The indoor units sound pressure shall range from 30 dB(A) to 45 dB(A) at High speed measured at 5 feet below the unit.
b. Indoor Unit:
1) The Daikin indoor unit FXFQ_T shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, condensate drain pan, condensate drain pump, condensate safety shutoff and alarm, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch.
2) Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.
3) Both refrigerant lines shall be insulated from the outdoor unit.
4) The round flow supply air flow can be field modified to 23 different airflow patterns to accommodate various installation configurations including corner installations.
5) Return air shall be through the concentric panel, which includes a resin net, mold resistant, antibacterial filter.
6) The indoor units shall be equipped with a condensate pan with antibacterial

treatment and condensate pump. The condensate pump provides up to 33-1/2" of lift from bottom of unit to top of drain piping and has a built in safety shutoff and alarm.
7) The indoor units shall be equipped with a return air thermistor.
8) The indoor unit will be separately powered with 208~230V/1-phase/60Hz.
9) The voltage range will be 253 volts maximum and 187 volts minimum.
10) To save energy and optimize occupancy comfort, the indoor unit shall be equipped with built in occupancy sensor and surface temperature sensor.
11) Supplied air shall be directed automatically by four individually controlled louvers.

c. Unit Cabinet:
1) The cabinet shall be space saving and shall be located into the ceiling.
2) Four auto-adjusted louvers shall be available to choose, which include standard, draft prevention and ceiling stain prevention.
3) The airflow of the unit shall have the ability to shut down outlets with multiple patterns allowing for simpler installation in irregular spaces.
4) Fresh air intake shall be possible by way of Daikin's optional fresh air intake kit.
5) A branch duct knockout shall exist for branch ducting of supply air.
6) The cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation.
7) Optional high efficiency air filters are available for each model unit.

d. Fan:
1) The fan shall be direct-drive DC (ECM) type fan, statically and dynamically balanced impeller with three fan speeds available.
2) The fan motor shall operate on 208/230 volts, 1 phase, 60 hertz with a motor output range from 0.08 to 0.16 HP.
3) The airflow rate shall be available in three manual settings.
4) The DC fan shall be able to automatically adjust the fan speed in 5 speeds based on the space load.
5) The fan motor shall be equipped as standard with adjustable external static pressure (ESP) settings to allow operation with the high efficiency air filter options.
6) The fan motor shall be thermally protected.

e. Filter:
1) High efficiency disposable air filters.

f. Coil:
1) Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
2) The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
3) The coil shall be a 2, or 3-row cross fin copper evaporator coil with up to 21 FPI design completely factory tested.
4) The refrigerant connections shall be flare connections and the condensate will be 1-1/4 inch outside diameter PVC.
5) A condensate pan with antibacterial treatment shall be located under the coil.
6) A thermistor will be located on the liquid and gas line.

g. Electrical:
1) A separate power supply will be required of 208/230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.
2) Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
3) Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

h. Control:
1) The unit shall have controls provided by Daikin to perform input functions

necessary to operate the system.

2) The unit shall be compatible with interfacing with a BMS system via optional LonWorks or BACnet gateways.
3) The unit shall be compatible with a Daikin Intelligent Touch Manager advanced multi-zone controller.
4) For the Sensing functions and the optional Self-Cleaning Filter functions, Remote controller BRC1E73/BRC1E52B7 shall be used. Consult with Daikin prior to applying controls.

i. Accessories:
1) A high efficiency disposable air filter kit.
2) Remote “in-room” sensor kit (KRCS01-4B): The Daikin wall mounted, hard wired remote sensor kit is recommended for when a NAV controller is not used or when the NAV controller is not located in the space that is being controlled. The sensor for detecting the temperature can be placed away from the indoor unit (branch wiring is included in the kit).

12. FXTQ_TA – Multi-Position Air Handling:
a. General: Daikin indoor unit FXTQ_TA shall be a floor mounted vertical, horizontal left, horizontal right, or downflow air handling unit, operable with refrigerant R-410A, equipped with an electronic expansion valve and direct-drive ECM type fan with constant CFM programming, for installation within a conditioned space. When installed in a vertical configuration it shall have top discharge air and bottom return air. When installed in a horizontal right or horizontal left configuration, it shall have a horizontal discharge air and horizontal return air. When installed in a downflow configuration it shall have bottom discharge and top return air. This compact design with pre-painted heavy-gauge steel casing shall be available in capacities from 9,500 Btu/h to 60,000 Btu/h. Model numbers FXTQ30TAVJUA, FXTQ42TAVJUA, FXTQ48TAVJUA , FXTQ54TAVJUA, and FXTQ60TAVJUA to be connected to outdoor unit model REYQ heat recovery model. A KRCS01-4B remote temperature sensor kit shall be required for all FXTQ indoor units not utilizing the thermistor in the Daikin remote controller BRC1E73. Computerized PID control shall be used to control superheat to deliver a comfortable room temperature condition. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature when used with Daikin remote control BRC1E73 and BRC2A71.
b. Performance: Each unit’s performance is based on nominal operating conditions:

Model Number	**Cooling** (Indoor 80°F DB/ 67°F WB, Outdoor 95°F DB, 25 ft pipe length)	**Heating** (Indoor 47°F DB/ 43°F WB, Outdoor 70°F DB, 25 ft pipe length)
FXTQ30TAVJUA(D)	30,000	34,000
FXTQ42TAVJUA(D)	42,000	47,500
FXTQ48TAVJUA(D)	48,000	54,000
FXTQ54TAVJUA(D)	54,000	61,000
FXTQ60TAVJUA(D)	60,000	68,000

c. Indoor Unit:
1) The Daikin indoor unit FXTQ_TA components shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, brazed connections, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch.
2) Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.
3) Both refrigerant lines shall be insulated from the outdoor unit.
4) Return air shall be through an optional or field supplied filter.
5) Condensate draining shall be made via gravity or external condensate pump.
6) The indoor unit will be separately powered with 208~230V/1-phase/60Hz.
7) The voltage range will be 253 volts maximum and 187 volts minimum.

d. Unit Cabinet:
8) The cabinet shall be constructed with sound absorbing, foil-faced insulation to control

air leakage.

9) Select an installation location with adequate structural support, space for service access and clearance for air return and supply duct connections.
10) A field supplied secondary drain pan shall be installed where required by national, state, or local code.

e. Fan:
11) The fan shall be a direct-drive Sirocco type fan, statically and dynamically balanced impeller with high and low fan speeds available.
12) The fan motor shall operate on 208/230 volts, 1 phase, 60 hertz with a motor output range 0.2 to 1.0. HP.
13) The airflow rate shall be available in high setting.
14) The fan motor shall be thermally protected.
15) Fan motor external static pressure for nominal airflow:

Model Number	Fan ESP (in. WG)
FXTQ30TAVJUA(D)	Up to 0.9
FXTQ42TAVJUA(D)	Up to 0.9
FXTQ48TAVJUA(D)	Up to 0.9
FXTQ54TAVJUA(D)	Up to 0.9
FXTQ60TAVJUA(D)	Up to 0.9

f. Filter:
16) The return air shall be filtered by means of an optional or field supplied filter.
g. Coil:
17) Coils shall be of the direct expansion type constructed from aluminum tubes expanded into aluminum fins to form a mechanical bond.
18) The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
19) The coils shall be a 2- to 4-row cross fin copper evaporator coil with 14 to 16 fpi design completely factory tested.
20) The refrigerant connections shall be brazed connections and the condensate will be 3/4 inch outside diameter PVC.
21) A thermistor will be located on the liquid and gas line.
h. Electrical:
22) A separate power supply will be required of 208/230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.
23) Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
24) Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.
i. Control:
25) The unit shall have controls provided by Daikin to perform input functions necessary to operate the system.
26) The unit shall be compatible with interfacing with a BMS system via optional LonWorks or BACnet gateways.
27) The unit shall be compatible with a Daikin Intelligent Touch Manager advanced multi-zone controller.
j. Optional Accessories Available:
28) Field installed 3-25kW electric heaters (HKS-03, HKS-05, HKS-06, HKS-08, HKS-10, HKS-15, HKS-19, HKS-20, HKS-25).
29) Air filter (ALFH1620, ALFH1912201E, ALFH20231E).
30) Downflow kit: DFK-B, DFK-C, DFK-D.
31) BRC4C84 wireless controller.

13. FXMQ_PB – Concealed Ceiling Ducted Unit (Med. Static):
a. General: Daikin indoor unit FXMQ_PB shall be a built-in ceiling concealed fan coil unit, operable with refrigerant R-410A, equipped with an electronic expansion valve, direct-drive DC (ECM) type fan with auto CFM adjustment at commissioning, for installation into the ceiling cavity. It is constructed of a galvanized steel casing. It shall be available in capacities from 7,500 Btu/h to 48,000 Btu/h. Model numbers are FXMQ07PBVJU, FXMQ09PBVJU, FXMQ12PBVJU, FXMQ15PBVJU, FXMQ18PBVJU, FXMQ24PBVJU, FXMQ30PBVJU, FXMQ36PBVJU,

FXMQ48PBVJU, and FXMQ54PBVJU to be connected to outdoor unit model RXYQ/ RXYMQ / RWEYQ heat pump and REYQ/ RWEYQ heat recovery model. It shall be a horizontal discharge air with horizontal return air configuration. All models feature a low height cabinet making them applicable to ceiling pockets that tend to be shallow. Computerized PID control shall be used to control superheat to deliver a comfortable room temperature condition. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature when used with Daikin remote control BRC1E72, BRC1E73 and BRC2A71. Included as standard equipment, a condensate drain pan and drain pump kit that pumps to 18-3/8" from the drainpipe opening. The indoor units sound pressure shall range from 29 dB(A) to 43 dB(A) at low speed measured 5 feet below the ducted unit.

b. Indoor Unit:
   1) The Daikin indoor unit FXMQ_PB shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, condensate drain pan, condensate drain pump, condensate safety shutoff and alarm, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch. The unit shall be equipment with automatically adjusting external static pressure logic that is selectable during commissioning. This adjusts the airflow based on the installed external static pressure.
   2) Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.
   3) Both refrigerant lines shall be insulated from the outdoor unit.
   4) The indoor units shall be equipped with a condensate pan and condensate pump. The condensate pump provides up to 18-3/8" of lift from the center of the drain outlet and has a built in safety shutoff and alarm.
   5) The indoor units shall be equipped with a return air thermistor.
   6) The indoor unit will be separately powered with 208~230V/1-phase/60Hz.
   7) The voltage range will be 253 volts maximum and 187 volts minimum.
c. Unit Cabinet:
   1) The cabinet shall be located into the ceiling and ducted to the supply and return openings.
   2) The cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation.
d. Fan:
   1) The fan shall be direct-drive DC (ECM) type fan, statically and dynamically balanced impeller with three fan speeds available.
   2) The unit shall be equipment with automatically adjusting external static pressure logic selectable during commissioning.
   3) The fan motor shall operate on 208/230 volts, 1 phase, 60 hertz with a motor output range of 0.12 to 0.47 HP respectively.
   4) The airflow rate shall be available in three settings.
   5) The fan motor shall be thermally protected.
   6) The fan motor shall be equipped as standard with adjustable external static pressure (ESP) settings.
e. Coil:
   1) Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
   2) The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
   3) The coil shall be a 3 row cross fin copper evaporator coil with 15 fpi design completely factory tested.
   4) The refrigerant connections shall be flare connections and the condensate will be 1-1/4" outside diameter PVC.

5) A condensate pan shall be located under the coil.
6) A condensate pump with an 18-3/8” lift shall be located below the coil in the condensate pan with a built in safety alarm.
7) A thermistor will be located on the liquid and gas line.

f. Electrical:
1) A separate power supply will be required of 208/230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.
2) Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
3) Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

g. Control:
1) The unit shall have controls provided by Daikin to perform input functions necessary to operate the system.
2) The unit shall be compatible with interfacing with a BMS system via optional LonWorks or BACnet gateways.
3) The unit shall be compatible with a Daikin Intelligent Touch Manager advanced multi-zone controller.

h. Accessories:
1) Remote “in-room” sensor kit KRCS01-4B: The Daikin wall mounted, hard wired remote sensor kit is recommended for when a NAV controller is not used or when the NAV controller is not located in the space that is being controlled. The sensor for detecting the temperature can be placed away from the indoor unit (branch wiring is included in the kit).
2) MERV 13 Filter kit. Can be configured for right or left access. Filters replaceable without tools.

14. FXMQ PVJU Concealed Ceiling Ducted Unit (Med. Static):
a. General: Daikin indoor unit FXMQ shall be a built-in ceiling concealed fan coil unit, operable with refrigerant R-410A, equipped with an electronic expansion valve, for installation into the ceiling cavity. It is constructed of a galvanized steel casing. It shall be available from 7,500 Btu/h to 96,000 Btu/h capacities. It shall be a horizontal discharge air with horizontal return air configuration. All models feature a low height (11-13/16") cabinet making them applicable to ceiling pockets that tend to be shallow. Computerized PID control shall be used to control superheat to deliver a comfortable room temperature condition. The unit shall be equipped with a programmed drying mechanism that dehumidifies while inhibiting changes in room temperature when used with Daikin remote control BRC1D71 and BRC2A71. Fan motor shall be ECM type for reduced energy use.
b. Indoor Unit:
1) The Daikin indoor unit FXMQ shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch. The unit shall have an adjustable external static pressure switch.
2) Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.
3) Both refrigerant lines shall be insulated from the outdoor unit.
4) The indoor units shall be equipped with a return air thermistor.
5) The indoor unit will be separately powered with 208~230V/ 1-phase/60Hz.
c. Unit Cabinet:
1) The cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation.
d. Fan:
1) The fan shall be direct-drive Sirocco type fan, statically and dynamically balanced impeller with high and low fan speeds available.

2) The fan motor shall operate on 208/ 230 volts, 1 phase, 60 hertz.
3) The airflow rate shall be available in high, medium, and low settings.
4) The fan motor shall be thermally protected.
5) Fan motor will be direct current ECM type.
6) Time saving at commissioning with automatic adjusting of airflow based on field installed ductwork.

e. Coil:
1) Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
2) The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
3) The coil shall be a 3 row cross fin copper evaporator coil with 13 fpi design completely factory tested.
4) The refrigerant connections shall be flare connections and the condensate will be 1-1/4 inch outside diameter PVC.
5) A thermistor will be located on the liquid and gas line.
6) A silver ion antibacterial agent is installed in the drain pan to reduce the chance of mold build up.

f. Control:
1) The unit shall have controls provided by Daikin to perform input functions necessary to operate the system.

g. Accessories:
1) Condensate pump.

15. Unit Ventilator:
a. Description & Certification:
1) The supplier shall provide a vertical upflow configuration classroom ventilator. Exterior wall mounted unit will not be acceptable. The unit shall be a complete, factory finished, Changeair unit ventilator manufactured by Changeair a Systemair company.
2) Units shall be CSA, UL or ETL certified and labeled indicating that the equipment has been independently tested and meets the applicable safety standards required both in the United States and Canada. Units shall be manufactured in an ISO 9001 registered facility or by a company manufacturing ventilation equipment for at least ten years.
3) Manufacturer shall provide sound data in accordance with AHRI Standard 260 "*Sound Rating of Ducted Air Moving and Conditioning Equipment*".
4) Data to be collected in a qualified and accredited reverberant Laboratory.
5) Sound Ratings are to be in the form of Octave Band Sound Power Levels (dB) from 63 to 8000 Hz derived from One-Third Octave Band measurements.
6) Data provided must meet or exceed minimum requirements for use within ANSI S12.60-2010 calculations.

b. Cabinet Construction:
1) Cabinet construction should be such that internal 16-gauge frame supports all internal metal pans and components. Exterior panels should not support any internal components.
2) The outer cabinet will be made of 20-gauge steel with a powder coat baked enamel-textured finish to an appliance standard. The cabinet panels shall attach to the frame without visible screws, rivets, or fasteners.
3) The cabinet front shall incorporate two fully insulated full sized hinged panels held closed by no less than two tamper resistant cam lock in each panel. Manufacturer shall supply four, half turn adjustable, dual action cam fasteners operated with a removable key/tool.
4) Cabinet panels shall be thermally/acoustically insulated with 1" (2.54 cm) thick flexible fiberglass insulation, covered in the air stream with a black coated mat. All exposed edges to be sealed. Density to be a minimum of 1.5

lb/ft³. Insulation shall comply with 25/50 Flame Smoke requirement as per UL 1995/ CSA 22.2 No. 236 standards in addition to UL94-HF-1 flame rating. Insulation with only UL94-HF-1 flame rating is not acceptable.

c. Air Distribution:
   1) A duct collar 24" x 12" is supplied with the unit ventilator for connection of ductwork. Ducting and ceiling diffusers should be sized to operate with the units at .25" ESP or less. All external ductwork and diffusers must be correctly sized, fabricated, and supplied by installer. Ducting must be insulated for the first 10 feet from the unit.
   2) The unit shall be supplied with matching color standard blade or airfoil blade return grille, see drawings for number and exact location.
d. Filters:
   1) Each unit shall be equipped with a 2" pleated disposable filter. The location of the filter shall provide 100% filtration of both re-circulated and outside fresh air.
e. Cooling:
   1) The drain pan shall be constructed from stainless steel metal.
   2) A primary direct expansion (DX) coil shall be provided in the evaporator coil section mounted into place with condensate drain pan and lines. The coil shall be constructed of copper tubes mechanically burred to .006" with corrugated aluminum fins permanently bonded to the tubes to prevent electrolytic action. The coil shall be installed with a thermal expansion valve correctly sized to match the remote condensing unit together providing the cooling capacity required by the schedule at the maximum efficiency for the system. Unless specified the remote condensing unit and warranty for air conditioning performance are the responsibility of the mechanical engineer and/or contractor.
f. Variable Refrigerant Volume (VRV) Air Conditioning – Heat Recovery/ Heat Pump Air Handling Unit Integration Kit, Daikin Model Number:
   1) EKEQFCBAV3-US – AHU INTEGRATION KIT (W-CONTROL BOX)
   2) EKEXV125-US – AHU INTEGRATION KIT EXPANSION VALVE 48 MBH
g. Quality Assurance:
   1) The units shall be tested by a Nationally Recognized Testing Laboratory (NRTL), in accordance with ANSI/UL 1995/CAN/CSA-C22.2 No. 236-05 (R2009) – Heating and Cooling Equipment and shall bear the Listed Mark.
   2) All wiring shall be in accordance with the California Electrical Code (CEC).
   3) The system will be produced in an ISO 9001 and ISO 14001 facility, which are standards set by the International Standard Organization (ISO). The system shall be factory tested for safety and function.
h. Delivery, Storage and Handling:
   1) Unit shall be stored and handled according to the manufacturer's recommendations.
i. Standard Limited Warranty:
   1) Daikin North America LLC warrants original owner of the non-residential building, multifamily residence, or residence in which the Daikin products are installed that under normal use and maintenance for comfort cooling and conditioning applications such products (the "Products") will be free from defects in material workmanship. This warranty applies to compressor and all parts and is limited in duration to ten (10) years starting from the "installation date" which is one of the two dates below:
      a) The installation date is the date that the unit is original commissioned, but no later than 18 months after the manufacture date noted on the unit's rating plate.
      b) If the date the unit is originally commissioned cannot be verified, the installation date is three months after the manufacture date.
   2) Complete warranty details are available from your local Daikin representative

or at www.daikincomfort.com.

j. Design Basis: The HVAC equipment basis of design is Daikin. All bidders shall furnish the minimum system standards as defined by the base bid model numbers, model families or as otherwise specified herein (see Key General Specifications Alternate Supplier Checklist). In any event the contractor shall be responsible for all specified I terms and intents of this document without further compensation.

k. EKEQFCBAV3-US:
   1) General:
      a) Daikin model EKEQFCBAV3-US control box shall be used to control the flow of R-410a refrigerant to a non-VRV air handling unit connected to a VRV condensing unit by means of an appropriate Daikin EKEXV***-US expansion valve kit. Each EKEQFCBAV3-US control shall be paired with no more than one EKEXV***-US expansion valve kit. The EKEQFCBAV3-US shall control the refrigerant flow as determined by a 0-10VDC input provided by a field-supplied DDC controller.
      b) The unit shall be furnished with 2 thermistors required for control of the expansion valve. These thermistors shall be field-installed in the air handling unit as required.
      c) The unit shall be furnished with 9 capacity setting adaptors, each corresponding to an appropriate EKEXV***-US capacity selection.
      d) The unit shall be furnished with a conduit mounting plate and sealing gasket.
   2) Unit Enclosure:
      a) The unit enclosure shall be constructed of a polymer resin suitable for indoor or outdoor installation in accordance with UL1995.
      b) The units shall be constructed such that the when the cover is opened for electrical connections, the cover shall remain attached to the body of the control box.
   3) Electrical:
      a) A separate power supply will be required of 208/230 volts, 1 phase, 60 hertz.
      b) The acceptable voltage range shall be 187 to 253 volts.
   4) Transmission (control) wiring between the EKEQFCBAV3-US and the VRV outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
   5) The length of transmission (control) wiring between the EKEQFCBAV3-US and the field-supplied DDC controller shall be determined by the DDC manufacturer.
   6) The length of transmission (power and control) wiring between the EKEQFCBAV3-US and the EKEXV***-US shall be a maximum of 65 feet (20m).
   7) All wiring shall be in accordance with California Electric Code (CEC) and any applicable local or regional codes.

l. Control:
   1) The EKEQFCBAV3-US shall receive a 0-10V DC input from a field-supplied DDC controller.
   2) The VRV outdoor unit shall adjust the system target evaporating temperature (in cooling mode) and target condensing temperature (in heating mode) in response to the 0-10V DC input.
   3) The unit shall receive a 16V DC analog input from the included liquid pipe thermistor attached to the field supplied air handling unit. The thermistor shall be field-installed as necessary with the included 8.5 feet of wiring.
   4) The unit shall receive a 16V DC analog input from the included gas pipe thermistor attached to the field supplied air handling unit. The thermistor shall be field-installed as necessary.
   5) The unit shall be compatible with the Daikin BRC1E72, BRC1E73, and BRC2A71 indoor unit controllers for purposes of field-setting and

troubleshooting purposes only. These controllers shall not be used for controlling refrigerant flow to the expansion valve.

6) The unit shall be capable of receiving a contact input On/ Off signal.
7) The unit shall provide a 16V DC output to the EKEXV_-US expansion valve. This output shall provide both power and communication/control to the expansion valve.
8) The unit shall provide a voltage-free contact signal output for use with the air handling unit fan operation. Additional fan speed control shall be via the DDC controller or other Building Management System control.
9) The unit shall provide a voltage-free contact signal output indicating compressor on/ off operation.
10) The unit shall provide a voltage-free contact error signal output.
11) The unit shall provide a voltage-free contact signal output indicating the VRV outdoor unit is in a defrost cycle.
12) The VRT function for the VRV outdoor unit shall be automatically disabled upon connection of the EKEQFCBAV3-US.
13) The unit shall be capable of wiring to the Daikin VRV D-III Net communication using the F1, F2 terminal block.

m. Accessories:
1) The unit shall be compatible with the BRC1E72, the BRC1E72, and the BRC2A71 for field setting and troubleshooting purposes only.
2) The unit shall be compatible with the I-Touch Manager (DCM601A71).
3) The unit shall be compatible with the following expansion valve kits: EKEXV63-US, EKEXV80-US, EKEXV100-US, EKEXV125-US, EKEXV140-US, EKEXV200-US, EKEXV250-US, EKEXV400-US, EKEXV500-US.
4) The unit shall be compatible with DACA-KRCS-PW40 and DACA-KRCS-PW80 thermistor cables.

n. EKEXV***-US:
1) General:
a) Daikin model EKEXV***-US expansion valve kit shall be used to control the flow of R-410a refrigerant to a non-VRV air handling unit connected to a VRV condensing unit. Each EKEXV***-US shall be paired with one EKEQ*CBAV3-US control box. The EKEXV***-US shall be compatible with R-410a refrigerant and shall be capable of an expansion valve control resolution of 2000 pulses. It shall be available in nominal capacities from 18,000 Btu/ h to 192,000 Btu/h.
2) Performance:
a) The unit's performance shall be determined by the selected operating conditions, and shall fall within the following range:

Model Number	Nominal Capacity	Cooling Capacity (Btu/h)		Heating Capacity (Btu/h)	
		Min.	Max.	Min.	Max.
EKEXV125-US	48 Mbh	42,500	52,500	47,500	59,000

3) Unit Enclosure:
a) The unit enclosure shall be constructed of a heavy gauge sheet metal with a powder coat finish and shall be suitable for both indoor and outdoor installation.
4) Piping:
a) All piping within the unit shall be copper.
b) The unit shall be furnished with refrigerant filter/driers on both the inlet and outlet piping to the expansion valve.
c) External refrigerant connections to the unit shall be brazed connections.
d) Both refrigerant lines shall be fully insulated from the outdoor unit.
5) Electrical:

a) The unit shall not require a dedicated power connection. Power to the expansion valve shall be provided via 12V DC input connection from the paired EKEQ*CBAV3-US control box.
b) The power wiring connection shall be made using the factory included 18 AWG wiring harness. The connection shall be capable of up to 65 ft (20m) of wiring length.

6) Control:
a) The control signal to the EKEXV***-US shall be received via the factory included 18 AWG wiring harness. The connection shall be capable of up to 65 ft. (20m) of wiring length.

o. Dampers and Damper Actuators:
1) The return and outside air dampers shall be a low leakage parallel blade design. The frame and blades shall be constructed of extruded aluminum with blade design being streamline or airfoil construction, operated by zero maintenance, concealed linkage, ½" (13mm) axles bolted to the blades shall operate on bronze iolite bearings. Both blade edge and jamb seals shall be of the pressure sensitive type for low leakage.
2) The outside air intake to the energy recovery wheel shall be equipped with a low leakage parallel blade design damper to eliminate outside air from entering the unit during unoccupied periods. The damper shall be powered with a spring return actuator.
3) The dampers shall be equipped with a Belimo spring return damper actuator with a minimum torque of 18 in/lb. The actuator must provide proportional damper control in response to input of 2 to 10 VDC. Actuators shall use a brushless DC motor controlled by a microprocessor and be protected from overload at all angles of rotation.
4) The relief fan shall be manufactured with a standard pressure sensitive static relief damper not requiring an actuator.
5) The outside air/economizer damper must facilitate the introduction of a nominal 100% outside air, bypassing the recovery system during "free cooling" cycles.

p. Supply Fans and Motors:
1) Supply Motor and Fan Assembly shall consist of two fan bodies to supply the specified cfm. Each fan body shall be a double inlet centrifugal type blower with the two fans driven by one electrically commutated motor (ECM). The ECM shall be programmed to deliver the specified cfm. Each fan body shall be a double inlet centrifugal type blower with the two fans driven by one electrically commutated motor (ECM). The ECM shall be programmed to deliver the specified airflow at a maximum external static pressure of .25" w.c. Standard permanent split capacitor (PSC) motors will not be acceptable.
2) Motor fan shall be isolated from the supply fan by using the metal motor mount bracket and rubber insulator. Fan assembly slider shall sit on felt insulation.
3) The supply fan shall be orientated in a design position such that the mixed air will be drawn through both the heating and cooling coils before reaching the supply fan.

q. Relief Fan and Motor:
1) Relief motor fan assembly shall consist of one fan to supply the specified cfm. Fan body shall be a double inlet centrifugal type blower. An electrically commutated motor (ECM) programmed to deliver the specified airflow will drive the fan. Fan shall be capable of 100% relief.

r. Energy Recovery Wheel:
1) The recovery component shall incorporate a rotary wheel in an insulated cassette frame complete with seals, drive motor and drive belt. The total energy recovery wheel shall be coated with silica gel desiccant permanently bonded. The substrate shall be lightweight polymer. Coating segments shall

be washable, and desiccant shall not dissolve nor deliquesce in the presence of water or high humidity.

2) Thermal performance of the energy wheel shall be certified by the manufacturer in accordance with ASHRAE Standard 84 and shall be listed in the ARI Certified Products.

3) Relief air volume through the wheel shall be a maximum of 450 cfm. The motor fan assembly shall consist of a single ECM fan and shall be an integral part of the recovery system drawing air through the energy recovery wheel at the same rate and capacity that outside air is entering the room.

4) Frost protection for the ERW is provided by ensuring the Relief air from the wheel stays above the frost threshold (22F). In the event the air temperature drops, the Relief fan shall ramp up keeping the air temperature above the threshold.

s. Electrical Specifications:

1) The main power supply shall connect to the unit through a wire race way directly to either a terminal block or to the unfused disconnect provided by the unit manufacturer. Standard electrical supply voltage shall be _____VAC _____phase 60 Hz.

t. Service Disconnect:

1) Each unit shall be supplied with a line voltage service disconnect and a door switch for control voltage interrupt to disable the mechanical components when the service panel is removed. The disconnect switch is lockable in off position (standard on all units except electric heated models).

2) Each unit shall be supplied with a door switch for control voltage interrupt to disable the mechanical components when the service panel is removed.

u. Factory Training, Installation, Start-up, On-site Testing, Demonstrations and Manuals:

1) Installation shall be in full accordance to the manufacturer's instructions, generally accepted practice and all applicable codes. The manufacturer shall not be responsible for improper application or installation, which may invalidate the warranty. Some models and installations may require the contractor to fabricate or extend a wall sleeve, check drawings and equipment specifications. Contractors are responsible for protecting the units from damage during construction. Contractor shall clean or replace filters prior to turning the building over to the owner. UNITS ARE NOT CERTIFIED AS CONSTRUCTION HEATERS, USING THEM IN THIS MANNER MAY VOID WARRANTY.

2) The manufacturer's agent that supplies the equipment shall be responsible for overseeing or reviewing the installation at the initial start-up or soon thereafter. The agent will also demonstrate to the building maintenance personnel the operation of the unit(s) and explain warranty procedures.

3) At completion of the installation the manufacturer will provide the owner with 3 sets of installation, operation and service manuals with shop drawings and electrical diagram.

4) The manufacturer shall supply a limited one year warranty on all parts. Also, a limited three-year warranty on the damper actuator.

5) Together with the parts only warranty, the manufacture shall cover labor for replacement of approved parts at the standard labor rate and time as per the flat rate time chart supplied by the manufacturer. This optional labor warranty shall be for a period of (1) year (s).

v. Controls Factory Installed – Supplied by Daikin:

1) A single source electrical panel is required for high and low voltage electrical wiring. Fuses, relays, wiring, control transformer, all control connection points, and controllers must be located inside the single source electrical panel.

2) Controls contractor must coordinate with manufacture to ensure physical

dimensions of the controller are compatible for a single source electrical panel.

3) A fully programmable, direct digital, controller shall be supplied to the factory for installation by the factory during assembly. All peripheral devices required must be preapproved and must be shipped with the controller. The factory is not responsible for programming, addressing or sequence of operations.
4) The factory will network with the controls supplier to determine wiring connections and location of peripherals. The factory will not test or commission the controller or external devices.
5) The controls supplier shall be responsible for coordinating with the factory to determine proper wiring connections, they shall be responsible to deliver the controller with any external devices within the time schedules set up by the factory and they shall be responsible for all programming, testing and site commissioning of the controls system.

w. Air Quality Monitors/ Controllers & Other Sensors:
1) A Dual Pressure Transducers shall be supplied for units with an Energy Recovery Wheel. This device shall measure the pressure drops for the Intake and Relief sides of the ERW to ensure accurate airflow in both streams. The device combined with the ECM Relief Fan shall make the ERW self-balancing.

x. Plenums, Stand-offs & Pipe Chases:
1) A 3 sided, non-insulated cosmetic top duct cover shall be included with each unit ventilator. The cover shall be constructed of heavy 18-gauge steel with textured powder coat painted finish to match unit ventilator. The top duct cover comes in 3 standard heights 20”, 30”, & 50” that can be cut down to ceiling height.
2) A rear plenum shall be included with each unit ventilator. The plenum shall be constructed of heavy 18 gauge steel with 1” (2.54 cm) flange for unit mount and painted in textured powder coat finished to match cabinet color. The plenum is factory insulated with 1” (2.54 cm) acoustic material and includes a full uninsulated back. The standoff is supplied assembled with field mounting to the unit required.

16. FXAQ – Wall Mounted Unit:
a. General: Daikin indoor unit FXAQ shall be a wall mounted fan coil unit, operable with refrigerant R-410A, equipped with an electronic expansion valve, for installation onto a wall within a conditioned space. This compact design with finished white casing shall be available in capacities from 7,500 Btu/h to 24,000 Btu/h. Model numbers are FXAQ07PVJU, FXAQ09PVJU, FXAQ12PVJU, FXAQ18PVJU and FXAQ24PVJU to be connected to outdoor unit model RXYQ/ RXYMQ / RWEYQ heat pump and REYQ / RWEYQ heat recovery model. Computerized PID control shall be used to control superheat to deliver a comfortable room temperature condition. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature when used with Daikin remote control BRC1E72, BRC1E73 and BRC2A71. A mildew-proof, polystyrene condensate drain pan and resin net mold resistant filter shall be included as standard equipment. The indoor units sound pressure shall range from 31 dB(A) to 41 dB(A) at low speed measured at 3.3 feet below and from the unit.
b. Performance: Each unit’s performance is based on nominal operating conditions:

Model Number	**Cooling** (Indoor 80°F DB / 67°F WB, Outdoor 95°F DB, 25 ft pipe length)	**Heating** (Indoor 47°F DB / 43°F WB, Outdoor 70°F DB, 25 ft pipe length)
FXAQ07PVJU	7,500	8,500

FXAQ09PVJU	9,500	10,500
FXAQ12PVJU	12,000	13,500
FXAQ18PVJU	18,000	20,000
FXAQ24PVJU	24,000	26,500

c. Indoor Unit:
   1) The Daikin indoor unit FXAQ shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, condensate drain pan, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch. The unit shall have an auto-swing louver which ensures efficient air distribution, which closes automatically when the unit stops. The remote controller shall be able to set five (5) steps of discharge angle. The front grille shall be easily removed for washing. The discharge angle shall automatically set at the same angle as the previous operation upon restart. The drainpipe can be fitted to from either left or right sides.
   2) Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.
   3) Both refrigerant lines shall be insulated from the outdoor unit.
   4) Return air shall be through a resin net mold resistant filter.
   5) The indoor units shall be equipped with a condensate pan.
   6) The indoor units shall be equipped with a return air thermistor.
   7) The indoor unit will be separately powered with 208~230V/1-phase/60Hz.
   8) The voltage range will be 253 volts maximum and 187 volts minimum.

d. Unit Cabinet:
   1) The cabinet shall be affixed to a factory supplied wall mounting template and located in the conditioned space.
   2) The cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation.

e. Fan:
   1) The fan shall be a direct-drive cross-flow fan, statically and dynamically balanced impeller with high and low fan speeds available.
   2) The fan motor shall operate on 208/230 volts, 1 phase, 60 hertz with a motor output range 0.054 to 0.058 HP.
   3) The airflow rate shall be available in high and low settings.
   4) The fan motor shall be thermally protected.

f. Coil:
   1) Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
   2) The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
   3) The coil shall be a 2-row cross fin copper evaporator coil with 14 fpi design completely factory tested.
   4) The refrigerant connections shall be flare connections and the condensate will be 11/16 inch outside diameter PVC.
   5) A thermistor will be located on the liquid and gas line.
   6) A condensate pan shall be located in the unit.

g. Electrical:
   1) A separate power supply will be required of 208/230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.
   2) Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
   3) Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

h. Control:

1) The unit shall have controls provided by Daikin to perform input functions necessary to operate the system.
2) The unit shall be compatible with interfacing with a BMS system via optional LonWorks or BACnet gateways.
3) The unit shall be compatible with a Daikin Intelligent Touch Manager advanced multi-zone controller.

i. Optional Accessories Available:
1) Remote "in-room" sensor kit KRCS01-1B.
2) A condensate pump (DACA-CP3-1).

17. FXNQ – Floor Console Concealed Unit:

a. General: Daikin indoor unit FXNQ shall be a floor or wall mounted console fan coil unit, operable with refrigerant R-410A, equipped with an electronic expansion valve, for installation within a conditioned space. It shall have a top discharge air grill and filtered bottom return air. This compact design unfinished casing shall be in capacities of 24,000 Btu/h. Model numbers are FXNQ24MVJU9 to be connected to outdoor unit model REYQ heat recovery model. The cabinets can be mounted on the floor with refrigerant and condensate lines directed downward or affixed to the wall with horizontal refrigerant and condensate knockouts. Computerized PID control shall be used to control superheat to deliver a comfortable room temperature condition. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature when used with Daikin remote control BRC1E72, BRC1E73 and BRC2A71. A mold-resistant, resin net air filter shall be included as standard equipment. The indoor units sound pressure shall range from 35 dB(A) to 40 dB(A) at high speed measured at 5 feet away and 5 feet high.

b. Performance: Each unit's performance is based on nominal operating conditions:

Model Number	**Cooling** (Indoor 80°F DB / 67°F WB, Outdoor 95°F DB, 25 ft pipe length)	**Heating** (Indoor 47°F DB / 43°F WB, Outdoor 70°F DB, 25 ft pipe length)
FXNQ24MVJU9	24,000	27,000

c. Indoor Unit:
1) The Daikin indoor unit FXNQ shall be completely factory assembled and tested. included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch. The unit shall have an auto-swing louver which ensures efficient air distribution, which closes automatically when the unit stops.
2) Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.
3) Both refrigerant lines shall be insulated from the outdoor unit.
4) Return air shall be through a resin net mold resistant filter.
5) Condensate draining shall be made via gravity or external condensate pump.
6) The indoor units shall be equipped with a return air thermistor.
7) The indoor unit will be separately powered with 208~230V/1-phase/60Hz.
8) The voltage range will be 253 volts maximum and 187 volts minimum.

d. Unit Cabinet:
1) The cabinet shall be affixed to a factory supplied wall mounting template and located in the conditioned space.
2) The cabinet shall be constructed with sound absorbing fiberglass urethane foam insulation.
3) Maintenance access shall be a minimum of ¾ inch in the rear, 4 inches on the right and left sides.

e. Fan:

1) The fan shall be a direct-drive Sirocco type fan, statically and dynamically balanced impeller with high and low fan speeds available.
2) The fan motor shall operate on 208/230 volts, 1 phase, 60 hertz with a motor output range 0.034 to 0.047 HP.
3) The airflow rate shall be available in high and low settings.
4) The fan motor shall be thermally protected.

f. Filter:
1) The return air shall be filtered by means of a washable long-life filter with mildew proof resin.

g. Coil:
1) Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
2) The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
3) The coil shall be a 3-row cross fin copper evaporator coil with 17 fpi design completely factory tested.
4) The refrigerant connections shall be flare connections and the condensate will be 27/32 inch outside diameter PVC.
5) A thermistor will be located on the liquid and gas line.

h. Electrical:
1) A separate power supply will be required of 208/230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.
2) Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
3) Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

i. Control:
1) The unit shall have controls provided by Daikin to perform input functions necessary to operate the system.
2) The unit shall be compatible with interfacing with a BMS system via optional LonWorks or BACnet gateways.
3) The unit shall be compatible with a Daikin Intelligent Touch Manager advanced multi-zone controller.

j. Optional Accessories Available:
1) Remote “in-room” sensor kit KRCS01-1B
2) Condensate pump (DACA-CP1-3)

18. FXUQ – 4 Way Ceiling Suspended Cassette Unit:

a. General: Daikin indoor unit model FXUQ shall be a ceiling suspended cassette fan coil unit, operable with R-410A refrigerant, equipped with an electronic expansion valve, for installation onto a ceiling within a conditioned space. It shall be capacities of 36,000 Btu/h. Model numbers are FXUQ36PVJU to be connected to outdoor unit model REYQ heat recovery model. It shall be a four-way air distribution type, fresh white, impact resistant with a washable panel. The supply air is distributed via motorized louvers which can be horizontally and vertically adjusted from 0° to 60°. Computerized PID control shall be used to control superheat to deliver a comfortable room temperature condition. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature when used with Daikin remote control BRC1E73. The indoor units sound pressure shall range from 36 dB(A) to 40 dB(A) at low speed measured at 5 feet below the unit.

b. Performance: Each unit’s performance is based on nominal operating conditions:

Model Number	**Cooling** (Indoor 80°F DB / 67°F WB, Outdoor 95°F DB, 25 ft pipe length)	**Heating** (Indoor 47°F DB / 43°F WB, Outdoor 70°F DB, 25 ft pipe length)

FXUQ36PVJU	36,000	40,000

c. Indoor Unit:
   1) The Daikin indoor unit FXUQ shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, condensate drain pan, condensate safety shutoff and alarm, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch.
   2) Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.
   3) Both refrigerant lines shall be insulated from the outdoor unit.
   4) The 4-way supply air flow can be field modified to 3-way and 2-way airflow to accommodate various installation configurations including corner installations.
   5) Return air shall be through the concentric panel, which includes a resin net mold resistant filter.
   6) The indoor units shall be equipped with a condensate pan and condensate pump. The condensate pump provides up to 23-5/8” of lift and has a built in safety shutoff and alarm.
   7) The indoor units shall be equipped with a return air thermistor.
   8) All electrical components are reached through the decoration panel, which reduces the required side service access.
   9) The indoor unit will be separately powered with 208~230V/1-phase/60Hz.
   10) The voltage range will be 253 volts maximum and 187 volts minimum.

d. Unit Cabinet:
   1) The cabinet shall be space saving and shall be located into the ceiling.
   2) Three auto-swing positions shall be available to choose, which include standard, draft prevention and ceiling stain prevention.
   3) The airflow of the unit shall have the ability to shut down outlets with multiple patterns allowing for simpler installation in irregular spaces.
   4) The cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation.

e. Fan:
   1) The fan shall be direct-drive turbo fan type with statically and dynamically balanced impeller with three fan speeds available.
   2) The fan motor shall operate on 208/230 volts, 1 phase, 60 hertz with a motor output range from 0.06 to 0.14 HP.
   3) The airflow rate shall be available in three settings.
   4) The fan motor shall be thermally protected.

f. Filter:
   1) The return air shall be filtered by means of a washable long-life filter with mildew proof resin.

g. Coil:
   1) Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
   2) The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
   3) The coil shall be a 3-row cross fin copper evaporator coil with 21 FPI design completely factory tested.
   4) The refrigerant connections shall be flare connections and the condensate will be 1 inch outside diameter PVC.
   5) A condensate pan with antibacterial treatment shall be located under the coil.
   6) A condensate pump with a 23-5/8 inch lift shall be located below the coil in the condensate pan with a built-in safety alarm.
   7) A thermistor will be located on the liquid and gas line.

h. Electrical:
   1) A separate power supply will be required of 208/230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.
   2) Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
   3) Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

i. Control:
   1) The unit shall have controls provided by Daikin to perform input functions necessary to operate the system.
   2) The unit shall be compatible with interfacing with a BMS system via optional LonWorks or BACnet gateways.
   3) The unit shall be compatible with a Daikin Intelligent Touch Manager advanced multi-zone controller.

j. Optional Accessories Available:
   1) Remote “in-room” sensor kit (KRCS01-4B):
      a) The Daikin wall mounted, hard wired remote sensor kit is recommended for ceiling-embedded type fan coils, which often result in a difference between set temperature and actual temperature. The sensor for detecting the temperature can be placed away from the indoor unit (branch wiring is included in the kit).
   2) Sensor Kit (BRE49B1F):
      a) The infrared presence sensor can detect human presence and adjust the airflow direction automatically to prevent drafts. Optional and configurable energy saving occupancy control can be performed when no presence is detected.
      b) The infrared floor sensor can detect the floor temperature and automatically adjust operation of the indoor unit to provide an improved and even temperature distribution.
   3) Air Outlet Blocking Decoration Panel (KDBTP49B140).
   4) Blocking Material Kit for 2-way Discharge (KDBHP49B140).

19. FXZQ – 4 Way Ceiling Cassette Unit (2’x2’):
   a. General: Daikin indoor unit model FXZQ shall be a ceiling cassette fan coil unit, operable with R-410A refrigerant, equipped with an electronic expansion valve, for installation into the ceiling cavity equipped with an air panel grill. It shall be available in capacities from 7,500 Btu/h to 18,000 Btu/h. Model numbers are FXZQ07MVJU9, FXZQ09MVJU9, FXZQ12MVJU9, FXZQ15MVJU9, FXZQ18MVJU9 to be connected to outdoor unit model RXYQ / RXYMQ / RWEYQ heat pump and REYQ / RWEYQ heat recovery model. It shall be a four-way air distribution type, white (RAL9010), impact resistant with a washable decoration panel. The supply air is distributed via motorized louvers which can be horizontally and vertically adjusted from 0° to 90°. Computerized PID control shall be used to control superheat to deliver a comfortable room temperature condition. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature when used with Daikin remote control BRC1E72, BRC1E73 and BRC2A71. The indoor units sound pressure shall range from 29 dB(A) to 34 dB(A) at low speed measured at 5 feet below the unit.
   b. Performance: Each unit’s performance is based on nominal operating conditions:

Model Number	**Cooling** (Indoor 80°F DB / 67°F WB, Outdoor 95°F DB, 25 ft pipe length)	**Heating** (Indoor 47°F DB / 43°F WB, Outdoor 70°F DB, 25 ft pipe length)
FXZQ07MVJU9	7,500	8,700
FXZQ09MVJU9	9,500	11,100
FXZQ12MVJU9	12,000	14,000

FXZQ15MVJU9	15000	17,500
FXZQ18MVJU9	18,000	21,000

c. Indoor Unit:
   1) The Daikin indoor unit FXZQ shall be completely factory assembled and tested.
   2) Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, condensate drain pan, condensate drain pump, condensate safety shutoff and alarm, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch.
   3) Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.
   4) Both refrigerant lines shall be insulated from the outdoor unit.
   5) The 4-way supply air flow can be field modified to 3-way and 2-way airflow to accommodate various installation configurations including corner installations.
   6) Return air shall be through the concentric panel, which includes a resin net mold resistant filter.
   7) The indoor units shall be equipped with a condensate pan and condensate pump. The condensate pump provides up to 21” of lift and has a built in safety shutoff and alarm.
   8) The indoor units shall be equipped with a return air thermistor.
   9) All electrical components are reached through the decoration panel, which reduces the required side service access.
   10) The indoor unit will be separately powered with 208~230V/1-phase/60Hz.
   11) The voltage range will be 253 volts maximum and 187 volts minimum.

d. Unit Cabinet:
   1) The cabinet shall be space saving and shall be located into the ceiling.
   2) Three auto-swing positions shall be available to choose, which include standard, draft prevention and ceiling stain prevention.
   3) The airflow of the unit shall have the ability to shut down one or two sides allowing for simpler corner installation.
   4) Fresh air intake shall be possible by way of direct duct installation to the side of the indoor unit cabinet.
   5) The cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation.

e. Fan:
   1) The fan shall be direct-drive turbo fan type with statically and dynamically balanced impeller with high and low fan speeds available.
   2) The fan motor shall operate on 208/230 volts, 1 phase, 60 hertz with a motor output range from 0.06 to 0.12 HP.
   3) The airflow rate shall be available in high and low settings.
   4) The fan motor shall be thermally protected.

f. Filter:
   1) The return air shall be filtered by means of a washable long-life filter with mildew proof resin.

g. Coil:
   1) Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
   2) The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
   3) The coil shall be a 2-row cross fin copper evaporator coil with 17 FPI design completely factory tested.
   4) The refrigerant connections shall be flare connections and the condensate will be 1 -1/32 inch outside diameter PVC.

5) A condensate pan shall be located under the coil.
6) A condensate pump with a 21 inch lift shall be located below the coil in the condensate pan with a built in safety alarm.
7) A thermistor will be located on the liquid and gas line.

h. Electrical:
1) A separate power supply will be required of 208/230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.
2) Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
3) Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

i. Control:
1) The unit shall have controls provided by Daikin to perform input functions necessary to operate the system.
2) The unit shall be compatible with interfacing with a BMS system via optional LonWorks or BACnet gateways.
3) The unit shall be compatible with a Daikin Intelligent Touch Manager advanced multi-zone controller.

j. Optional Accessories Available:
1) Direct fresh air intake kit (KDDQ44X60).
2) Supply air duct connections.
3) Remote “in-room” sensor kit (KRCS01-1B).
a) The Daikin wall mounted, hard wired remote sensor kit is recommended for ceiling-embedded type fan coils, which often result in a difference between set temperature and actual temperature. The sensor for detecting the temperature can be placed away from the indoor unit (branch wiring is included in the kit).

20. i-Touch Controller: The intelligent Touch Controller is capable of controlling/ monitoring up to 64 groups of indoor units (hereafter “groups”). The main functions of the intelligent Touch Controller shall include:
a. Collective starting/stopping of operation of the indoor units connected to the intelligent Touch Controller.
b. Starting/stopping of operation, temperature setting, switching between temperature control modes and enabling/disabling of operation with the hand-held remote control by zone or group.
c. Scheduling by zone or group.
d. Monitoring of the operation status by zone or group.
e. Display of the air conditioner operation history.
f. Compulsory contact stop input from the central monitoring panel (non-voltage, normally-open contact).
g. Web based option: i-Touch will come with web based option to allow access from remote location and to send e-mail to two locations in the event of a malfunction.

OR

G. Variable Refrigerant Volume (VRVIV-S) Air Conditioning Specification – Heat Pump:
1. System Description:
a. The variable capacity, heat pump air conditioning system shall be a Daikin Variable Refrigerant Volume Series (heat/cool model) split system. The system shall consist of multiple evaporators using PID control, and Daikin VRV®IV-S model condensing unit. The RXTQ outdoor units shall be a nominal 3 ton, 4 ton, or 5 ton direct expansion (DX), air-cooled heat pump air-conditioning system, inverter driven variable speed compressor, multi-zone split system, using R-410A refrigerant. The outdoor unit may connect an indoor evaporator capacity up to 130% to that of the outdoor condensing unit capacity. All indoor units are each capable of operating separately with individual temperature control.

b. The Daikin outdoor unit shall be interconnected to indoor unit models FXFQ, FXEQ, FXUQ, FXHQ, FXMQ, FXLQ, FXNQ, FXTQ, FXDQ, FXZQ, FXAQ and FXMQ_MF and shall range in capacity from 7,500 Btu/h to 54,000 Btu/h in accordance with Daikin's engineering data book detailing each available indoor unit. The indoor units shall be connected to the condensing unit utilizing Daikin's REFNET™ specified piping joints and headers to ensure correct refrigerant flow and balancing. T style joints are not acceptable.
c. Operation of the system shall permit either cooling or heating of all of the indoor units. Each indoor unit or group of indoor units shall be able to provide set temperature independently via a local remote controller, an Intelligent Touch Controller (ITC), an Intelligent Touch Manager (ITM) or a BMS interface.
d. The RXTQ outdoor unit model numbers and the associated number of connectable indoor units per RXTQ outdoor unit is indicated in the following table. Each indoor unit or group of indoor units shall be independently controlled.

Model Number	Nominal Capacity (Tons)	Number of Connectable Indoor Units
RXTQ36TAVJU	3	6
RXTQ48TAVJU	4	8
RXTQ60TAVJU	5	10

2. VRVIV-S Features and Benefits:
   a. Voltage Platform: Heat pump condensing units shall be available in 208-230V/1/60 configurations.
   b. Advanced Zoning: A single system shall provide for up to 10 zones.
   c. Independent Control: Each indoor unit shall use a dedicated electronic expansion valve for independent control.
   d. VFD Inverter Control: Each condensing unit shall use a high efficiency, variable speed "inverter" compressor coupled with inverter fan motors for superior part load performance.
   e. Compressor capacity shall be modulated automatically to maintain a constant suction pressure, while varying the refrigerant volume for the needs of the cooling or heating loads.
   f. Indoor units shall use PID control to control superheat to deliver a comfortable room temperature condition.
   g. Variable Refrigerant Temperature (VRT) Control: Each condensing unit shall utilize an algorithm to automatically adjust the refrigerant suction and condensing temperatures in response to the heating and cooling loads, and in response to the current weather conditions. The VRT control shall be capable of being customized in the following modes and sub-modes:
      1) Automatic (factory preset): The Automatic VRT mode shall allow the target evaporator temperature (Te) and target condensing temperature (Tc) to float based on outdoor ambient temperature conditions, and shall incorporate the following sub-modes: Powerful, Quick, and Mild (factory preset).
      2) High Sensible: The High Sensible mode shall allow the system Te and Tc values to be programmed to series of fixed Te and Tc values. The High Sensible mode shall also be capable of incorporating the following sub-mode: Eco.
      3) Basic: The Basic mode shall disable the VRT control of the outdoor unit and allow the system to operate with constant Te and Tc values.
   h. Flexible Design:
      1) Systems shall be capable of up to 230ft (70m) of linear piping (295ft/ 90m equivalent length) between the condensing unit and furthest located indoor unit.
      2) Systems shall be capable of up to 984ft (300m) total "one-way" piping in the piping network.

3) Systems shall have a vertical (height) separation of up to 98ft between the condensing unit and the indoor unit units.
4) The outdoor unit shall connect an indoor evaporator capacity up to 130% of the outdoor condensing unit capacity.

i. Simple Wiring: Systems shall use 2 wire, multi-stranded, non-shielded and non-polarized daisy chain control wiring.
j. Space Saving: Each system shall have a condensing unit module footprint of the following dimensions:
RXTQ36TAVJU: 39”H x 37”W x 12-5/8”D
RXTQ48TAVJU: 39”H x 37”W x 12-5/8”D
RXTQ60TAVJU: 52-15/16”H x 35-7/16”W x 12-5/8”D
k. Advanced Diagnostics: Systems shall include a self -diagnostic, auto-check function to detect a malfunction and display the type and location.
l. Advanced Controls: Each system shall have at least one remote controller capable of controlling up to 16 indoor unit units.

3. Quality Assurance:
a. The units shall be tested by a Nationally Recognized Testing Laboratory (NRTL), in accordance with ANSI/UL 1995 – Heating and Cooling Equipment and bear the Listed Mark.
b. All wiring shall be in accordance with the National Electric Code (NEC).
c. Each combination shall be rated in accordance with Air Conditioning, Heating and Refrigeration Institute’s (AHRI) Standard 210/240 and bear the AHRI label.
d. The system will be produced in an ISO 9001 and ISO 14001 facility, which are standards set by the International Standard Organization (ISO). The system shall be factory tested for safety and function.
e. The outdoor unit will be factory charged with R-410A.

4. Delivery, Storage and Handling:
a. Unit shall be stored and handled according to the manufacturer’s recommendations.

5. Standard Limited Warranty:
a. Daikin North America LLC warrants original owner of the non-residential building, multifamily residence, or residence in which the Daikin products are installed that under normal use and maintenance for comfort cooling and conditioning applications such products (the “Products”) will be free from defects in material and workmanship. This warranty applies to compressor and all parts and is limited in duration to ten (10) years starting from the ‘’installation date’’ which is one of the two dates below:
1) The installation date is the date that the unit is originally commissioned, but no later than 18 months after the manufacture date noted on the unit’s rating plate.
2) If the date the unit is originally commissioned cannot be verified, the installation date is three months after the manufacture date.
b. Complete warranty details available from your local Daikin representative or at www.daikincomfort.com.

6. Operating Range:
a. The operating range in cooling will be 23°F DB to 122°F DB (-5°C – 50°C).
b. The operating range in heating will be -5°F WB to 60°F WB (-20°C – 15.5°C).
c. Cooling mode indoor room temperature range will be 57°F-77°F WB (14°C – 25°C).
d. Heating mode indoor room temperature range will be 59°F-80°F DB (15°C – 26.6°C).

7. Refrigerant Piping:
a. Model RXTQ36TAVJU - The system shall be capable of refrigerant piping up to 164 actual feet (50m) or 213 equivalent feet (65m) from the outdoor unit to the furthest indoor unit, a total combined liquid line length of 820 feet (250m) of piping between the condensing and indoor units, and with 98 feet (30m) maximum vertical

difference between the outdoor unit and indoor units without any oil traps. The system shall be capable of 33 feet (10m) vertical separation between indoor units on the same system.

b. Models RXYQ48TAVJU and RXTQ60TAVJU – The system shall be capable of refrigerant piping up to 230 actual feet (70m) or 295 equivalent feet (90m) from the outdoor unit to the furthest indoor unit, a total combined liquid line length of 984 feet (300m) or piping between the condensing unit and indoor units, and with 98 feet (30m) maximum vertical difference between the outdoor unit and indoor units without any oil traps. The system shall be capable of 49 feet (15m) vertical separation between indoor units on the same system.

c. REFNET™ piping joints and headers shall be used to ensure proper refrigerant balance and flow for optimum system capacity and performance. T style joints shall not be acceptable as this will negatively impact proper refrigerant balance and flow for optimum system capacity and performance.

8. Design Basis:
   a. The HVAC equipment basis of design is Daikin. All bidders shall furnish the minimum system standards as defined by the base bid model numbers, model families or as otherwise specified herein. In any event, the contractor shall be responsible for all specified items and intents of this document without further compensation. Equal products of LG, Trane or Mitsubishi are acceptable.
9. Outdoor Unit:
   a. General: The outdoor unit is designed specifically for use with VRV series components.
      1) The outdoor unit shall be factory assembled and pre-wired with all necessary electronic and refrigerant controls. The refrigeration circuit of the condensing unit shall consist of a Daikin swing compressor, motors, fans, condenser coil, electronic expansion valves, solenoid valves, 4-way valve, distribution headers, capillaries, filters, shut off valves, oil separator, service ports and suction line accumulator. Liquid and suction lines must be individually insulated between the outdoor and indoor units.
      2) The outdoor unit can be wired and piped with outdoor unit access from the left, right, rear or bottom.
      3) The connection ratio of indoor units to outdoor unit shall be permitted up to 130%.
      4) The outdoor system shall be able to support the connection of up to 10 indoor unit's dependent on the model of the outdoor unit.
      5) The sound pressure level standard shall be that value as listed in the Daikin engineering manual for the specified models at 3 feet from the front of the unit. The outdoor unit shall be capable of operating automatically at further reduced noise during nighttime.
      6) The system will automatically restart operation after a power failure and will not cause any settings to be lost, thus eliminating the need for reprogramming.
      7) The outdoor unit shall allow for side-by-side installation with minimum spacing.
      8) The following safety devices shall be included on the condensing unit, high pressure switch, low pressure sensor, control circuit fuses, crankcase heaters, fusible plug, overload relay, inverter overload protector, thermal protectors for compressor and fan motors, over current protection for the inverter and anti-recycling timers.
      9) To ensure the liquid refrigerant does not flash when supplying to the various indoor unit units, the circuit shall be provided with a sub-cooling feature.
      10) Oil recovery cycle shall be automatic occurring 2 hours after start of operation and then every 8 hours of operation.
      11) The outdoor unit shall be capable of heating operation at 0°F dry bulb ambient temperature without additional low ambient controls.

b. Unit Cabinet:
   1) The outdoor unit shall be completely weatherproof and corrosion resistant. The unit shall be constructed from rust-proofed mild steel panels coated with a baked enamel finish.

c. Fan:
   1) The condensing unit fan(s) shall consist of propeller type, direct-drive fan motors that have multiple speed operation via a DC (digitally commutating) inverter.

Model Number	Fan Motor Output (W) & Quantity
RXTQ36TAVJU	200 x 1
RXTQ48TAVJU	200 x 2
RXTQ60TAVJU	70 x 2

   2) The fan shall be a horizontal discharge configuration with a nominal airflow maximum range of 3,740 CFM.
   3) Nominal sound pressure levels shall be as shown below:

Model Number	Sound Pressure Level dB(A) Cooling / Heating Modes
RXTQ36TAVJU	58 / 61
RXTQ48TAVJU	58 / 61
RXTQ60TAVJU	57 / 59

   4) The fan motor shall have inherent protection and permanently lubricated bearings and be mounted.
   5) The fan motor shall be provided with a fan guard to prevent contact with moving parts.

d. Condenser Coil:
   1) The condenser coil shall be manufactured from copper tubes expanded into aluminum fins to form a mechanical bond.
   2) The heat exchanger coil shall be of a waffle louver fin and rifled bore tube design to ensure high efficiency performance.
   3) The heat exchanger on the condensing units shall be manufactured from Hi-X seamless copper tube.
   4) The fins are to be covered with an anti-corrosion acrylic resin and hydrophilic film type E1.

e. Compressor:
   1) The Daikin inverter scroll compressor shall be variable speed (PAM inverter)
   2) controlled which is capable of changing the speed to follow the variations in total cooling and heating load as determined by the suction gas pressure as measured in the condensing unit. In addition, samplings of evaporator and condenser temperatures shall be made so that the high/low pressures detected are read every 20 seconds and calculated. With each reading, the compressor capacity shall be controlled to eliminate deviation from target value.
   3) The inverter driven compressor in each condensing unit shall be of highly efficient reluctance DC (digitally commutating), hermetically sealed swing type.
   4) Neodymium magnets shall be adopted in the rotor construction to yield a higher torque and efficiency in the compressor instead of the normal ferrite magnet type. At complete stop of the compressor, the neodymium magnets will position the rotor into the optimum position for a low torque start.
   5) The capacity control range shall be 14% to 100%.
   6) The compressor shall be equipped with a crankcase heater, high pressure

safety switch, and internal thermal overload protector.

7) Oil separators shall be standard with the equipment together with an intelligent oil management system.
8) The compressor shall be spring mounted to avoid the transmission of vibration.

f. Electrical:
1) The power supply to the outdoor unit shall be 208/230 volts, 1 phase, 60 hertz +/- 10%.

Power Supply Voltage	Voltage Range
208-230V/1/60	187V-253V

Model	MCA	MOP	Compressor RLA
RXTQ36TAVJU	16.5	25	15.3
RXTQ48TAVJU	29.1	35	19.0
RXYQ60TAVJU	29.1	35	23.2

2) The control voltage between the indoor and outdoor unit shall be 18VDC non-shielded, stranded 2 conductor cable.
3) The control wiring shall be a two-wire multiplex transmission system, making it possible to connect multiple indoor units to one outdoor unit with one 2-cable wire, thus simplifying the wiring operation.
4) The control wiring lengths shall be as shown below.

	Outdoor to Indoor Unit	Outdoor to Central Controller	Indoor Unit to Remote Control
Control Wiring Length	6,665 ft	3,330 ft	1,665 ft
Wire Type	18 AWG, 2 wire, non-polarity, non-shielded, stranded		

10. FXFQ_T – Round Flow Sensing Ceiling Cassette Unit:
a. General: Daikin indoor unit model FXFQ_T shall be a round flow ceiling cassette fan coil unit, operable with R-410A refrigerant, equipped with an electronic expansion valve, direct drive DC (ECM) type fan, for installation into the ceiling cavity equipped with an air panel grill. It shall be available in capacities from 7,500 Btu/h to 48,000 Btu/h. Model numbers are FXFQ07TVJU, FXFQ09TVJU, FXFQ12TVJU, FXFQ15TVJU, FXFQ18TVJU, FXFQ24TVJU, FXFQ30TVJU, FXFQ36TVJU, FXFQ48TVJU to be connected to outdoor unit model RXYQ / RXYMQ / RWEYQ heat pump and REYQ / RWEYQ heat recovery model. It shall be a round flow air distribution type, fresh white, impact resistant decoration panel, or optional self-cleaning filter panel. The supply air is distributed via four individually motorized louvers. To save energy and optimize occupancy comfort, the indoor unit shall be equipped with built in occupancy sensor and surface temperature sensor. Computerized PID control shall be used to control superheat to deliver a comfortable room temperature condition. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature when used with Daikin remote control BRC1E72, BRC1E73, BRC2A71 and BRC1E52B7. The indoor units sound pressure shall range from 30 dB(A) to 45 dB(A) at High speed measured at 5 feet below the unit.
b. Performance: Each unit's performance is based on nominal operating conditions:

Model Number	Cooling (Indoor 80°F DB/ 67°F WB,	Heating

	Outdoor 95°F DB, 25 ft pipe length)	(Indoor 47°F DB/ 43°F WB, Outdoor 70°F DB, 25 ft pipe length)
FXFQ07TVJU	7,500	8,500
FXFQ09TVJU	9,500	10,500
FXFQ12TVJU	12,000	13,500
FXFQ15TVJU	15,000	16,500
FXFQ18TVJU	18,000	20,000
FXFQ24TVJU	24,000	27,000
FXFQ30TVJU	30,000	34,000
FXFQ36TVJU	36,000	40,000
FXFQ48TVJU	48,000	54,000

c. Indoor Unit:
   1) The Daikin indoor unit FXFQ_T shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, condensate drain pan, condensate drain pump, condensate safety shutoff and alarm, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch.
   2) Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.
   3) Both refrigerant lines shall be insulated from the outdoor unit.
   4) The round flow supply air flow can be field modified to 23 different airflow patterns to accommodate various installation configurations including corner installations.
   5) Return air shall be through the concentric panel, which includes a resin net, mold resistant, antibacterial filter.
   6) The indoor units shall be equipped with a condensate pan with antibacterial treatment and condensate pump. The condensate pump provides up to 33-1/2” of lift from bottom of unit to top of drain piping and has a built in safety shutoff and alarm.
   7) The indoor units shall be equipped with a return air thermistor.
   8) The indoor unit will be separately powered with 208~230V/1-phase/60Hz.
   9) The voltage range will be 253 volts maximum and 187 volts minimum.
   10) To save energy and optimize occupancy comfort, the indoor unit shall be equipped with built in occupancy sensor and surface temperature sensor.
   11) Supplied air shall be directed automatically by four individually controlled louvers.

d. Unit Cabinet:
   1) The cabinet shall be space saving and shall be located into the ceiling.
   2) Four auto-adjusted louvers shall be available to choose, which include standard, draft prevention and ceiling stain prevention.
   3) The airflow of the unit shall have the ability to shut down outlets with multiple patterns allowing for simpler installation in irregular spaces.
   4) Fresh air intake shall be possible by way of Daikin’s optional fresh air intake kit.
   5) A branch duct knockout shall exist for branch ducting of supply air.
   6) The cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation.
   7) Optional high efficiency air filters are available for each model unit.

e. Fan:
   1) The fan shall be direct-drive DC (ECM) type fan, statically and dynamically balanced impeller with three fan speeds available.
   2) The fan motor shall operate on 208/230 volts, 1 phase, 60 hertz with a motor

output range from 0.08 to 0.16 HP.
3) The airflow rate shall be available in three manual settings.
4) The DC fan shall be able to automatically adjust the fan speed in 5 speeds based on the space load.
5) The fan motor shall be equipped as standard with adjustable external static pressure (ESP) settings to allow operation with the high efficiency air filter options.
6) The fan motor shall be thermally protected.

f. Filter:
1) The return air shall be filtered by means of a washable long-life filter with mildew proof resin and antibacterial treatment.
2) Optional high efficiency disposable air filters shall be available.
3) Optional Self-Cleaning Filter Panel, which performs automatic filter cleaning up to once a day, with dust collection box that indicates when to be emptied.

g. Coil:
1) Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
2) The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
3) The coil shall be a 2, or 3-row cross fin copper evaporator coil with up to 21 FPI design completely factory tested.
4) The refrigerant connections shall be flare connections and the condensate will be 1 -1/4 inch outside diameter PVC.
5) A condensate pan with antibacterial treatment shall be located under the coil.
6) A thermistor will be located on the liquid and gas line.

h. Electrical:
1) A separate power supply will be required of 208/230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.
2) Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
3) Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

i. Control:
1) The unit shall have controls provided by Daikin to perform input functions necessary to operate the system.
2) The unit shall be compatible with interfacing with a BMS system via optional LonWorks or BACnet gateways.
3) The unit shall be compatible with a Daikin Intelligent Touch Manager advanced multi-zone controller.
4) For the Sensing functions and the optional Self-Cleaning Filter functions, Remote controller BRC1E73/BRC1E52B7 shall be used. Consult with Daikin prior to applying controls.

j. Optional Accessories Available:
1) A high efficiency disposable air filter kit.
2) Air intake kit.
3) Self-Cleaning Filter Panel, which performs automatic filter cleaning up to once a day, with dust collection box that indicates when to be emptied.
4) Remote “in-room” sensor kit (KRCS01-4B).
5) The Daikin wall mounted, hard wired remote sensor kit is recommended for when a NAV controller is not used or when the NAV controller is not located in the space that is being controlled. The sensor for detecting the temperature can be placed away from the indoor unit (branch wiring is included in the kit).

11. FXMQ_M – Concealed Ceiling Ducted Unit (Med. Static):
a. General: Daikin indoor unit FXMQ_M shall be a built-in ceiling concealed fan coil unit, operable with refrigerant R-410A, equipped with an electronic expansion

valve, for installation into the ceiling cavity. It is constructed of a galvanized steel casing. It shall be available in capacities from 72,000 Btu/h to 96,000 Btu/h. Model numbers are FXMQ72MVJU and FXMQ96MVJU to be connected to outdoor unit model RXYQ / RWEYQ heat pump and REYQ / RWEYQ heat recovery model. It shall be a horizontal discharge air with horizontal return air configuration. All models feature a low height cabinet making them applicable to ceiling pockets that tend to be shallow. Computerized PID control shall be used to control superheat to deliver a comfortable room temperature condition. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature when used with Daikin remote control BRC1E72, BRC1E73 and BRC2A71. The indoor units sound pressure shall be 48 dB(A) at low speed measured 5 feet below the ducted unit.

b. Performance: Each unit's performance is based on nominal operating conditions:

Model Number	Cooling (Indoor 80°F DB / 67°F WB, Outdoor 95°F DB, 25 ft pipe length)	Heating (Indoor 47°F DB / 43°F WB, Outdoor 70°F DB, 25 ft pipe length)
FXMQ72MVJU	72,000	96,000
FXMQ96MVJU	96,000	108,000

c. Indoor Unit:
   1) The Daikin indoor unit FXMQ_M shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch. The unit shall have an adjustable external static pressure switch.
   2) Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.
   3) Both refrigerant lines shall be insulated from the outdoor unit.
   4) The indoor units shall be equipped with a return air thermistor.
   5) The indoor unit will be separately powered with 208~230V/1-phase/60Hz.
   6) The voltage range will be 253 volts maximum and 187 volts minimum.

d. Unit Cabinet:
   1) The cabinet shall be located into the ceiling and ducted to the supply and return openings.
   2) The cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation.

e. Fan:
   1) The fan shall be direct-drive Sirocco type fan, statically and dynamically balanced impeller with high and low fan speeds available.
   2) The fan motor shall operate on 208/230 volts, 1 phase, 60 hertz, with a motor output of 0.51 HP.
   3) The airflow rate shall be available in high and low settings.
   4) The fan motor shall be thermally protected.
   5) The fan motor shall be equipped as standard with adjustable external static pressure (ESP) settings.
   6) Fan motor external static pressure for nominal airflow:

Model Number	Fan ESP (in. WG)
FXMQ72MVJU	0.95 – 0.72
FXMQ96MVJU	0.95 – 0.8

f. Coil:
   1) Coils shall be of the direct expansion type constructed from copper tubes

expanded into aluminum fins to form a mechanical bond.
2) The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
3) The coil shall be a 3 row cross fin copper evaporator coil with 13 fpi design completely factory tested.
4) The refrigerant connections shall be flare connections and the condensate will be 1-5/16 inch outside diameter PVC.
5) A thermistor will be located on the liquid and gas line.

g. Electrical:
1) A separate power supply will be required of 208/230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.
2) Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
3) Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

h. Control:
1) The unit shall have controls provided by Daikin to perform input functions necessary to operate the system.
2) The unit shall be compatible with interfacing with a BMS system via optional LonWorks or BACnet gateways.
3) The unit shall be compatible with a Daikin Intelligent Touch Manager advanced multi-zone controller.

i. Optional Accessories Available:
1) Remote “in-room” sensor kit KRCS01-1B (recommended).
2) The Daikin wall mounted, hard wired remote sensor kit is recommended for ceiling-embedded type fan coils, which often result in a difference between set temperature and actual temperature. The sensor for detecting the temperature can be placed away from the indoor unit (branch wiring is included in the kit).

12. FXMQ_PA – Concealed Ceiling Ducted Unit (Med. Static):
a. General: Daikin indoor unit FXMQ_PA shall be a built-in ceiling concealed fan coil unit, operable with refrigerant R-410A, equipped with an electronic expansion valve, direct-drive DC (ECM) type fan with auto CFM adjustment at commissioning, for installation into the ceiling cavity. It is constructed of a galvanized steel casing. It shall be available in capacities from 7,500 Btu/h to 48,000 Btu/h. Model numbers are FXMQ07PAVJU, FXMQ09PAVJU, FXMQ12PAVJU, FXMQ15PAVJU, FXMQ18PAVJU, FXMQ24PAVJU, FXMQ30PAVJU, FXMQ36PAVJU, FXMQ48PAVJU, and FXMQ54PAVJU to be connected to outdoor unit model RXYQ / RXYMQ / RWEYQ heat pump and REYQ / RWEYQ heat recovery model. It shall be a horizontal discharge air with horizontal return air configuration. All models feature a low height cabinet making them applicable to ceiling pockets that tend to be shallow. Computerized PID control shall be used to control superheat to deliver a comfortable room temperature condition. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature when used with Daikin remote control BRC1E72, BRC1E73 and BRC2A71. Included as standard equipment, a condensate drain pan and drain pump kit that pumps to 18-3/8” from the drainpipe opening. The indoor units sound pressure shall range from 29 dB(A) to 43 dB(A) at low speed measured 5 feet below the ducted unit.
b. Performance: Each unit’s performance is based on nominal operating conditions:

Model Number	**Cooling** (Indoor 80°F DB / 67°F WB, Outdoor 95°F DB, 25 ft pipe length)	**Heating** (Indoor 47°F DB / 43°F WB, Outdoor 70°F DB, 25 ft pipe length)
FXMQ07PAVJU	7,500	8,500

FXMQ09PAVJU	9,500	10.500
FXMQ12PAVJU	12,000	13,500
FXMQ15PAVJU	15,000	16,500
FXMQ18PAVJU	18,000	20,000
FXMQ24PAVJU	24,000	27,000
FXMQ30PAVJU	30,000	34,000
FXMQ36PAVJU	36,000	40,000
FXMQ48PAVJU	48,000	54,000
FXMQ54PAVJU	54,000	60,000

c. Indoor Unit:
   1) The Daikin indoor unit FXMQ_PA shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, condensate drain pan, condensate drain pump, condensate safety shutoff and alarm, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch. The unit shall be equipment with automatically adjusting external static pressure logic that is selectable during commissioning. This adjusts the airflow based on the installed external static pressure.
   2) Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.
   3) Both refrigerant lines shall be insulated from the outdoor unit.
   4) The indoor units shall be equipped with a condensate pan and condensate pump. The condensate pump provides up to 18-3/8" of lift from the center of the drain outlet and has a built in safety shutoff and alarm.
   5) The indoor units shall be equipped with a return air thermistor.
   6) The indoor unit will be separately powered with 208~230V/1-phase/60Hz.
   7) The voltage range will be 253 volts maximum and 187 volts minimum.

d. Unit Cabinet:
   1) The cabinet shall be located into the ceiling and ducted to the supply and return openings.
   2) The cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation.

e. Fan:
   1) The fan shall be direct-drive DC (ECM) type fan, statically and dynamically balanced impeller with three fan speeds available.
   2) The unit shall be equipment with automatically adjusting external static pressure logic selectable during commissioning.
   3) The fan motor shall operate on 208/230 volts, 1 phase, 60 hertz with a motor output range of 0.12 to 0.47 HP respectively.
   4) The airflow rate shall be available in three settings.
   5) The fan motor shall be thermally protected.
   6) The fan motor shall be equipped as standard with adjustable external static pressure (ESP) settings.
   7) Fan motor external static pressure range for nominal airflow:

Model Number	Fan ESP (in. WG)
FXMQ07PAVJU	0.40 – 0.12
FXMQ09PAVJU	0.40 – 0.12
FXMQ12PAVJU	0.40 – 0.12
FXMQ15PAVJU	0.80 – 0.20
FXMQ18PAVJU	0.80 – 0.20
FXMQ24PAVJU	0.80 – 0.20
FXMQ30PAVJU	0.80 – 0.20

FXMQ36PAVJU	0.80 – 0.20
FXMQ48PAVJU	0.80 – 0.20
FXMQ54PAVJU	0.56 – 0.20

f. Coil:
   1) Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
   2) The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
   3) The coil shall be a 3 row cross fin copper evaporator coil with 15 fpi design completely factory tested.
   4) The refrigerant connections shall be flare connections and the condensate will be 1-1/4" outside diameter PVC.
   5) A condensate pan shall be located under the coil.
   6) A condensate pump with an 18-3/8" lift shall be located below the coil in the condensate pan with a built in safety alarm.
   7) A thermistor will be located on the liquid and gas line.

g. Electrical:
   1) A separate power supply will be required of 208/230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.
   2) Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
   3) Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

h. Control:
   1) The unit shall have controls provided by Daikin to perform input functions necessary to operate the system.
   2) The unit shall be compatible with interfacing with a BMS system via optional LonWorks or BACnet gateways.
   3) The unit shall be compatible with a Daikin Intelligent Touch Manager advanced multi-zone controller.

i. Optional Accessories Available:
   1) Remote "in-room" sensor kit KRCS01-4B (recommended).
      a) The Daikin wall mounted, hard wired remote sensor kit is recommended for when a NAV controller is not used or when the NAV controller is not located in the space that is being controlled. The sensor for detecting the temperature can be placed away from the indoor unit (branch wiring is included in the kit).
   2) MERV 13 Filter kit. Can be configured for right or left access. Filters replaceable without tools.
   3) Air side Economizer designed for connection to the rear of FXMQ30-54PAVJU.

13. FXMQ_PB – Concealed Ceiling Ducted Unit (Med. Static):
   a. General: Daikin indoor unit FXMQ_PB shall be a built-in ceiling concealed fan coil unit, operable with refrigerant R-410A, equipped with an electronic expansion valve, direct-drive DC (ECM) type fan with auto CFM adjustment at commissioning, for installation into the ceiling cavity. It is constructed of a galvanized steel casing. It shall be available in capacities from 7,500 Btu/h to 48,000 Btu/h. Model numbers are FXMQ07PBVJU, FXMQ09PBVJU, FXMQ12PBVJU, FXMQ15PBVJU, FXMQ18PBVJU, FXMQ24PBVJU, FXMQ30PBVJU, FXMQ36PBVJU, FXMQ48PBVJU, and FXMQ54PBVJU to be connected to outdoor unit model RXYQ / RXYMQ / RWEYQ heat pump and REYQ / RWEYQ heat recovery model. It shall be a horizontal discharge air with horizontal return air configuration. All models feature a low height cabinet making them applicable to ceiling pockets that tend to be shallow. Computerized PID control shall be used to control superheat to deliver a comfortable room temperature condition. The unit shall be equipped with

a programmed drying mechanism that dehumidifies while limiting changes in room temperature when used with Daikin remote control BRC1E72, BRC1E73 and BRC2A71. Included as standard equipment, a condensate drain pan and drain pump kit that pumps to 18-3/8" from the drainpipe opening. The indoor units sound pressure shall range from 29 dB(A) to 43 dB(A) at low speed measured 5 feet below the ducted unit.

b. Performance: Each unit's performance is based on nominal operating conditions:

Model Number	**Cooling** (Indoor 80°F DB / 67°F WB, Outdoor 95°F DB, 25 ft pipe length)	**Heating** (Indoor 47°F DB / 43°F WB, Outdoor 70°F DB, 25 ft pipe length)
FXMQ07PBVJU	7,500	8,500
FXMQ09PBVJU	9,500	10.500
FXMQ12PBVJU	12,000	13,500
FXMQ15PBVJU	15,000	16,500
FXMQ18PBVJU	18,000	20,000
FXMQ24PBVJU	24,000	27,000
FXMQ30PBVJU	30,000	34,000
FXMQ36PBVJU	36,000	40,000
FXMQ48PBVJU	48,000	54,000
FXMQ54PBVJU	54,000	60,000

c. Indoor Unit:
   1) The Daikin indoor unit FXMQ_PB shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, condensate drain pan, condensate drain pump, condensate safety shutoff and alarm, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch. The unit shall be equipment with automatically adjusting external static pressure logic that is selectable during commissioning. This adjusts the airflow based on the installed external static pressure.
   2) Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.
   3) Both refrigerant lines shall be insulated from the outdoor unit.
   4) The indoor units shall be equipped with a condensate pan and condensate pump. The condensate pump provides up to 18-3/8" of lift from the center of the drain outlet and has a built in safety shutoff and alarm.
   5) The indoor units shall be equipped with a return air thermistor.
   6) The indoor unit will be separately powered with 208~230V/1-phase/60Hz.
   7) The voltage range will be 253 volts maximum and 187 volts minimum.

d. Unit Cabinet:
   1) The cabinet shall be located into the ceiling and ducted to the supply and return openings.
   2) The cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation.

e. Fan:
   1) The fan shall be direct-drive DC (ECM) type fan, statically and dynamically balanced impeller with three fan speeds available.
   2) The unit shall be equipment with automatically adjusting external static pressure logic selectable during commissioning.
   3) The fan motor shall operate on 208/230 volts, 1 phase, 60 hertz with a motor output range of 0.12 to 0.47 HP respectively.

4) The airflow rate shall be available in three settings.
5) The fan motor shall be thermally protected.
6) The fan motor shall be equipped as standard with adjustable external static pressure (ESP) settings.
7) Fan motor external static pressure range for nominal airflow:

Model Number	Fan ESP (in. WG)
FXMQ07PBVJU	0.40 – 0.12
FXMQ09PBVJU	0.40 – 0.12
FXMQ12PBVJU	0.40 – 0.12
FXMQ15PBVJU	0.80 – 0.20
FXMQ18PBVJU	0.80 – 0.20
FXMQ24PBVJU	0.80 – 0.20
FXMQ30PBVJU	0.80 – 0.20
FXMQ36PBVJU	0.80 – 0.20
FXMQ48PBVJU	0.80 – 0.20
FXMQ54PBVJU	0.56 – 0.20

f. Coil:
1) Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
2) The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
3) The coil shall be a 3 row cross fin copper evaporator coil with 15 fpi design completely factory tested.
4) The refrigerant connections shall be flare connections and the condensate will be 1-1/4” outside diameter PVC.
5) A condensate pan shall be located under the coil.
6) A condensate pump with an 18-3/8” lift shall be located below the coil in the condensate pan with a built in safety alarm.
7) A thermistor will be located on the liquid and gas line.

g. Electrical:
1) A separate power supply will be required of 208/230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.
2) Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
3) Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

h. Control:
1) The unit shall have controls provided by Daikin to perform input functions necessary to operate the system.
2) The unit shall be compatible with interfacing with a BMS system via optional LonWorks or BACnet gateways.
3) The unit shall be compatible with a Daikin Intelligent Touch Manager advanced multi-zone controller.

i. Optional Accessories Available:
1) Remote “in-room” sensor kit KRCS01-4B (recommended).
a) The Daikin wall mounted, hard wired remote sensor kit is recommended for when a NAV controller is not used or when the NAV controller is not located in the space that is being controlled. The sensor for detecting the temperature can be placed away from the indoor unit (branch wiring is included in the kit).
2) MERV 13 Filter kit. Can be configured for right or left access. Filters replaceable without tools.
3) Air side Economizer designed for connection to the rear of FXMQ30-

54PBVJU.

14. FXAQ – Wall Mounted Unit:
    a. General: Daikin indoor unit FXAQ shall be a wall mounted fan coil unit, operable with refrigerant R-410A, equipped with an electronic expansion valve, for installation onto a wall within a conditioned space. This compact design with finished white casing shall be available in capacities from 7,500 Btu/h to 24,000 Btu/h. Model numbers are FXAQ07PVJU, FXAQ09PVJU, FXAQ12PVJU, FXAQ18PVJU and FXAQ24PVJU to be connected to outdoor unit model RXYQ/ RXYMQ / RWEYQ heat pump and REYQ / RWEYQ heat recovery model. Computerized PID control shall be used to control superheat to deliver a comfortable room temperature condition. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature when used with Daikin remote control BRC1E72, BRC1E73 and BRC2A71. A mildew-proof, polystyrene condensate drain pan and resin net mold resistant filter shall be included as standard equipment. The indoor units sound pressure shall range from 31 dB(A) to 41 dB(A) at low speed measured at 3.3 feet below and from the unit.
    b. Performance: Each unit's performance is based on nominal operating conditions:

Model Number	Cooling (Indoor 80°F DB / 67°F WB, Outdoor 95°F DB, 25 ft pipe length)	Heating (Indoor 47°F DB / 43°F WB, Outdoor 70°F DB, 25 ft pipe length)
FXAQ07PVJU	7,500	8,500
FXAQ09PVJU	9,500	10,500
FXAQ12PVJU	12,000	13,500
FXAQ18PVJU	18,000	20,000
FXAQ24PVJU	24,000	26,500

    c. Indoor Unit:
        1) The Daikin indoor unit FXAQ shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, condensate drain pan, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch. The unit shall have an auto-swing louver which ensures efficient air distribution, which closes automatically when the unit stops. The remote controller shall be able to set five (5) steps of discharge angle. The front grille shall be easily removed for washing. The discharge angle shall automatically set at the same angle as the previous operation upon restart. The drainpipe can be fitted to from either left or right sides.
        2) Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.
        3) Both refrigerant lines shall be insulated from the outdoor unit.
        4) Return air shall be through a resin net mold resistant filter.
        5) The indoor units shall be equipped with a condensate pan.
        6) The indoor units shall be equipped with a return air thermistor.
        7) The indoor unit will be separately powered with 208~230V/1-phase/60Hz.
        8) The voltage range will be 253 volts maximum and 187 volts minimum.
    d. Unit Cabinet:
        1) The cabinet shall be affixed to a factory supplied wall mounting template and located in the conditioned space.
        2) The cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation.
    e. Fan:
        1) The fan shall be a direct-drive cross-flow fan, statically and dynamically

balanced impeller with high and low fan speeds available.
2) The fan motor shall operate on 208/230 volts, 1 phase, 60 hertz with a motor output range 0.054 to 0.058 HP.
3) The airflow rate shall be available in high and low settings.
4) The fan motor shall be thermally protected.

f. Coil:
1) Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
2) The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
3) The coil shall be a 2-row cross fin copper evaporator coil with 14 fpi design completely factory tested.
4) The refrigerant connections shall be flare connections and the condensate will be 11/16 inch outside diameter PVC.
5) A thermistor will be located on the liquid and gas line.
6) A condensate pan shall be located in the unit.

g. Electrical:
1) A separate power supply will be required of 208/230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.
2) Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
3) Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

h. Control:
1) The unit shall have controls provided by Daikin to perform input functions necessary to operate the system.
2) The unit shall be compatible with interfacing with a BMS system via optional LonWorks or BACnet gateways.
3) The unit shall be compatible with a Daikin Intelligent Touch Manager advanced multi-zone controller.

i. Optional Accessories Available:
1) Remote “in-room” sensor kit KRCS01-1B.
2) A condensate pump (DACA-CP3-1).

H. Exhaust Fans:
1. General: All exhaust fans shall be tested and rated in accordance with AMCA Standard 210. Fans exposed to the weather shall have ventilated weatherproof housing over motor and drive assembly.
2. Ceiling Fan: Ceiling mounted direct drive centrifugal exhaust fan with exhaust grille. Motor mounted on rubber-in-shear isolators. Motor and fan removable through grille. Acoustically lined housing. Backdraft damper. UL listed. Penn, Cook, ACME, Greenheck or equal.
3. Kitchen Hood Fan: Multi-vane centrifugal fan. Ball bearings. Vibration isolation mount. All aluminum construction with steel or aluminum wheel, and aluminum curb base. Weatherproof disconnect switch. Upblast type UL listed for removal of smoke and grease laden vapors (YZHW, 762), for kitchen hood service. Cook, Greenheck, Penn, ACME or equal.
4. Residential Ceiling Fan: Ceiling mounted direct drive whisper quiet fan with DC motor that is variable speed and operates at a constant flow with varying static pressures. Energy Star rated and certified by the Home Ventilating Institute (HVI). Sound rating shall not exceed 1.0 sone as required by Title-24. Galvanized steel body, 4” diameter duct connection, built-in backdraft damper, expandable mounting bracket up to 24” and polypropylene ceiling grille with torsion springs. All controls shall be as scheduled on drawings. Factory warranty shall be 6 years limited on motor and 3 years limited on other parts. Panasonic, Air King, Broan or equal.
5. Smoke Control Fan: Heavy gauge aluminum propeller fan. Duplex split pillow block

ball bearings. All galvanized steel construction with a die formed flange, aluminum butterfly dampers, water trough for rain drainage, and curb base. Weatherproof disconnect switch. Fan shall be rated for 500°F air at 4 hours continuous. Upblast type UL listed for removal of smoke vapors. Greenheck or approved equal.

6. Fume Hood Fan: Multi-vane centrifugal fan. Ball bearings. Vibration isolation mount. All aluminum construction with steel or aluminum wheel, and aluminum curb base with built-in stack. Weatherproof disconnect switch. CFD and by-pass damper included. Upblast type UL listed for removal of chemical vapors, for fume hood service. Greenheck or approved equal.
7. Roof Fan: Multi-vane centrifugal fan. Ball bearings. Vibration isolation mount. All aluminum curb base. Weatherproof disconnect switch. Down blast type UL listed. Cook, Greenheck, Penn, ACME or equal.
8. In-Line Fan: Attic mounted direct drive centrifugal exhaust fan. Motor shall be open drip proof with permanently lubricated sealed bearings and built-in thermal overload protection and disconnect plug. Acoustic lined housing. Backdraft damper. UL listed. Provide 24”x24” access panel with cylinder key lock when above hard ceiling. Penn, Cook, ACME, Greenheck or equal.

I. Make-Up Air Unit (Direct):
1. General: Greenheck or equal shall be furnished per schedule. Equipment shall consist of a furnace section (fueled by natural gas), blower, and direct evaporative cooling section. The unit shall be tested as a complete package prior to shipment.
2. Furnace and Controls: Indirect fired gas furnace shall be 80% efficient, ETL list and certified to ANSI Z83-8. The furnace shall have a blow through fan design. Furnace shall be capable of operation with natural gas and have a power venting system. The burner and heat exchanger shall be constructed of stainless steel. Standard furnace features shall include main gas pressure regulator, main gas valve, electronic staged or electronic modulating controls, electronic intermittent pilot ignition system, high limit and a 24 volt control transformer.
3. Unit Casing and Frames: Unit shall be of double wall construction. Internal frame type construction of galvanized steel. All frames and panels shall be G90 galvanized steel. Where top panels are joined there shall be a standing seam to insure positive weather protection. All metal-to-metal surfaces exposed to the weather shall be sealed, requiring no caulking at job site. All components shall be easily accessible through removable doors. Insulation in accordance with NFPA 90A and tested to meet UL 181 erosion requirements and secured to unit with waterproof adhesive and permanent mechanical fasteners. Permatector exterior finish, color by Architect. Unit base to be designed for curb mounting, curb to be furnished with the unit. Unit base shall overhang the curb for a positive seal against water run-off.
4. Fan Section: Centrifugal fans shall be double width, double inlet. Fan and motor shall be mounted on a common base and shall be internally spring isolated. All blower wheels shall be statically and dynamically balanced. Ground and polished steel fan shafts shall be mounted in permanently lubricated ball bearings or ball bearing pillow blocks. Bearings shall be selected for a minimum (L10) life in excess of 100,000 hours at maximum cataloged speeds.
5. Motors and Drives: Motors shall be energy efficient, complying with EPACT standards, for single speed ODP and TE enclosures. Motors shall be permanently lubricated, heavy-duty type, matched to the fan load and furnished at the specified voltage, phase and enclosure. Drives shall be sized for a minimum of 150% of driven horsepower. Pulleys shall be cast and have machined surfaces, 10-horsepower and less shall be supplied with an adjustable drive pulley.
6. Electrical: All internal electrical components shall be prewired for single point power connection. All electrical components shall be UL listed, recognized, or classified where applicable and wired in compliance with the National Electrical Code. Control center shall include motor starter, control circuit fusing, control transformer for 120 VAC circuit, integral door interlocking disconnect switch with separate motor fusing and

terminal strip. Contactors Class 20 adjustable overload protection and single-phase protection shall be standard.

7. Filter Section: Filters shall be mounted in a V-bank arrangement such that velocities across the filters do not exceed 550.0 ft./ min. Filters shall be easily accessible through a removable access panel.
8. Direct Evaporative Cooling Section: Evaporative Cooling media shall be Munters CELdek with a depth of 12 inches for a cooling effectiveness of 90%, with a stainless steel housing all provided by the Heat Recovery Unit manufacturer. Drain and overflow connections with bleed kit shall be piped through the side of the HRE unit.
9. Weather Hood: Weather hoods shall be the same finish as the unit and shall be constructed of G90 galvanized steel with bird screen mounted at the intake.
10. Control Panel: Provide remote control panel with On-Off-Vent-Cool-Heat indicator lights and programmable thermostat control on face of panel. Permatector coated galvanized control panel.

J. Make-up Air Unit (Indirect/ Direct):

1. General: Greenheck or approved equal shall be furnished per schedule. Equipment shall consist of a furnace section (fueled by natural gas), outside air blower, exhaust air blower, indirect section (heat recovery ventilator) and direct evaporative cooling section. Units shall be listed per UL1812 and bear the UL label. Performance shall be as scheduled on plans. Exhaust discharge and outside air intake shall not be located on the same side on roof top units.
2. Unit Casing and Frames: Unit shall be of double wall construction. Internal frame type construction of galvanized steel. Frame and panels shall be G90 galvanized steel. All panels exposed to the weather shall be a minimum of 18 gauge galvanized steel. Unit shall be internally lined with galvanized sheet metal creating a double wall. Where top panels are joined there shall be a standing seam to insure positive weather protection. Unit casing to be insulated with 1-inch fiberglass. Insulation shall meet requirements of NFPA 90A and tested to meet UL 181 erosion requirements. Insulation to be enclosed in double wall construction. All metal-to-metal seams shall be sealed, requiring no caulking at job site. Permatector exterior finish, color by Architect. Unit base to be designed for curb mounting, curb to be furnished with the unit. Unit base shall overhang the curb for a positive seal against water run-off.
3. Weather hood: Weather hoods shall be the same finish as the unit. Outdoor air weather hood shall be tested in accordance with AMCA Standard 500-L to prevent water penetration up to 3 in/ hr at 29 mph.
4. Indirect Cooling Section (Heat Recovery Wheel): Wheel shall be designed for sensible heat recovery and be designed to insure laminar flow. Wheel shall be constructed of lightweight polymer media to minimize shaft and bearing loads. Polymer media shall be mounted in a stainless steel rotor for corrosion resistance. Wheel design shall consist of removable segments for ease of service and/ or cleaning.
5. Access Door: All components shall be easily accessible through removable doors for exhaust, supply, filter, and damper compartments. Heat recovery wheels (smaller than 24 inches) shall be mounted in a slide-out track for ease of inspection, removal, and cleaning.
6. Roof Curb: Roof curbs to be supplied by unit manufacturer for field assembly. Curb shall consist of die formed galvanized steel sections. Curb shall be full perimeter type with gasketing provided for field installation between curb and unit base.
7. Fan Section: Centrifugal fans to be double width, double inlet, forward curved type. All blower wheels shall be statically and dynamically balanced. Ground and polished steel fan shafts shall be mounted in permanently lubricated, sealed ball bearing pillow blocks. Bearings shall be selected for a minimum (L10) life in excess of 100,000 hours at maximum cataloged operating speeds. Separate motors for exhaust and supply blowers shall be provided. Adjustable sheaves on belt-driven fans with motors less than 10 hp shall allow independent balancing of exhaust and supply airflow. Fan and motor assemblies are mounted to unit base with neoprene isolators as standard. Fans

shall be located in draw-through position in reference to the energy recovery wheel.

8. Motors and Drives: Motors shall be energy efficient, complying with EPACT standards, for single speed ODP and TE enclosures. Motors shall be permanently lubricated, heavy-duty type matched to the fan load and furnished at the specified voltage, phase, and enclosure. Drives shall be sized for a minimum of 150% of driven horsepower. Pulleys shall be fully machined cast type, keyed and securely attached to the fan wheel and motor shafts; 10 horsepower and less shall be supplied with an adjustable drive pulley. Heat wheel motors shall have integral overload protection.
9. Filters: Supply and exhaust air filters shall be 2-inch thick pleated fiberglass, 30% efficient and tested to meet UL Class 2. Filter racks shall be die-formed galvanized steel.
10. Electrical: All internal electrical components shall be factory wired for single point power connection. Units with electrical reheat will be wired with independent power supply. All electrical components shall be UL Listed, Approved or Classified where applicable and wired in compliance with the National Electrical Code. Weatherproof, integral door interlocking disconnect switch, motor starters, control circuit fusing, and control transformer for 24 VAC circuit shall be supplied as standard components in the control center. Motor starters consist of a contactor and Class 20 electronic adjustable overload protection and shall be provided for all motors in the unit.
11. Direct Evaporative Cooling Section: Evaporative Cooling media shall be Munters CELdek with a depth of 12 inches for a cooling effectiveness of 90%, with a stainless steel housing all provided by the Heat Recovery Unit manufacturer. Drain and overflow connections with bleed kit shall be piped through the side of the HRE unit.
12. Furnace Section: Indirect Fired Gas furnace shall be 80% efficient, UL Certified per ANSI Z83.8 - 1996, C.G.A. approved per 2.6 - M96 and have a blow through fan design. Furnace shall be capable of operation with natural gas and have a power venting system. The burner and heat exchanger shall be constructed of stainless steel. Standard furnace features shall include pressure switch, main gas valve, electronic staged, electronic intermittent pilot ignition, high limit and a 24-volt control transformer.
13. Control Panel: Provide remote control panel with On-Off-Vent-Cool-Heat indicator lights and programmable thermostat control on face of panel. Permatector coated galvanized control panel.

K. Air Conditioning Unit (Above 25 Tons):
   1. Description:
      a. Self-Contained - Factory assembled and tested; designed for slab installation; and consisting of compressors, condensers, evaporator coils, condenser and evaporator fans, refrigeration, gas heater, filters, and dampers. Provide 5 year compressor warranty and 15 year non-prorated heat exchanger warranty. Aaon or approved equal.
   2. Construction:
      a. Unit shall be completely factory assembled, piped, and wired and shipped in one section.
      b. Unit shall be specifically designed for outdoor slab mount application with a fully weatherproof cabinet.
      c. All cabinet walls, access doors, roof and floor shall be a high performance composite panel constructed with G90 galvanized steel on both sides and a closed cell polyurethane foam interior core providing a rigid, impact resistant surface.
         1) The walls of the air tunnel compartments shall be 2 inches thick with a minimum R value of 12.5.
         2) The walls of the coil compartment shall be 1-½ inches thick with a minimum R value of 9.4.
         3) The roof of the air tunnel compartments shall be sloped at a minimum of ¼ inch per foot and shall be an average of 2-½ inches thick and an R value of 15.7.

4) The floor of the conditioned air and control compartments shall be 1 inch thick with a minimum R value of 6.25.
5) The access doors shall be 1-½ inches thick with a minimum R value of 9.4.
6) The foam shall have a minimum density of 2 pounds per cubic feet.
7) All foam material shall be tested in accordance with ASTM D-1929 for a minimum flash ignition temperature of 610 degrees F.
8) All panels shall have a thermal break with no metal path from inside to outside.

d. Paint finish shall be capable of withstanding at least 2000 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B 117-95 test procedure.
e. Unit specific color coded wiring diagrams shall match the unit color coded wiring and will be provided in both point-to-point and ladder form.
f. Diagrams shall also be laminated in plastic and permanently affixed inside the control compartment.
g. Access to filters, heating section, and other items needing periodic checking or maintenance shall be through hinged access doors with quarter turn lockable latches. Door fastening screws are not acceptable. The blower access door shall be bolted closed.
h. Access doors shall have stainless steel hinges and full perimeter gasketing.
i. All openings through the base pan of the unit shall have upturned flanges of at least 1/2" in height around the opening through the base pan.
j. Air side service access doors shall have rain break overhangs.
k. Unit shall have decals and tags to indicate unit lifting and rigging, service areas and caution areas. Installation and maintenance manuals shall be supplied with each unit.

3. Supply Fans:
   a. The fan shall be direct drive single width single inlet un-housed airfoil centrifugal, plenum fans. Supply fans shall have all aluminum construction. Fans attached to 1760 rpm motors shall be rated for a minimum of 1800 RPM maximum speed. Fans attached to 1170 rpm motors shall be rated for a minimum of 1200 RPM maximum speed. Direct drive fans shall be directly connected to and supported by the motor shaft. Motor bearings shall be rated for 200,000 hours service and shall have external lubrication connections. Fan(s) and motor(s) shall be dynamically balanced, and the entire fan assembly mounted on rubber isolators. Supply air shall be from the bottom of the cabinet. Variable Volume Systems VFD drive(s) shall be factory mounted and wired to the fan motor(s).
4. Outside Air:
   a. Shall be a fully modulating economizer integral controls. The outside air damper and return air damper assembly shall be constructed of extruded aluminum, hollow core, air foil blades with rubber edge seals and aluminum end seals. Damper blades shall be gear driven and designed to have no more than 25 CFM of leakage per sq. ft. of damper area when subjected to 2 in. w.g. air pressure differential across the damper. Damper motor shall be spring return to ensure closing of outdoor air damper during periods of unit shut down or power failure.
5. Return Fan Section:
   a. Power Return Fans: Axial flow direct drive fans shall be constructed of a polymeric material with fiberglass reinforcement and adjustable blade pitch. Direct drive fans shall be directly connected to and supported by the motor shaft. Motor bearings shall be rated for 200,000 hours service and shall have external lubrication connections. Fan(s) and motor(s) shall be dynamically balanced. Variable Volume Systems VFD drive(s) shall be factory mounted and wired to the fan motor(s).
6. Condenser:
   a. Air Cooled Condenser Section:
      1) The condensing section shall be equipped with vertical discharge axial flow direct drive fans. Direct drive fans shall be directly connected to and

supported by the motor shaft.

2) The condenser coils shall be sloped at least 30 degrees to protect the coils from damage.
3) Condenser coils shall be copper tubes with aluminum fins mechanically bonded to the tubes.
4) Condenser coils to be sized for a minimum of 10°F of refrigerant sub-cooling.
5) Provide 3/4"x18" GA. expanded aluminum condenser coil guards shop fabricated and installed by contractor.

7. Filters: 2-inch-thick, fiberglass, throwaway with an ASHRAE efficiency of 30%. With direct dial reading Magnehelic gauge mounted in the control compartment
8. Evaporator Coils:
   a. Evaporator coils shall be copper tube with aluminum fins mechanically bonded to the tubes.
   b. Evaporator coils shall have galvanized steel end casings.
   c. Evaporator coils shall have equalizing type vertical tube headers.
   d. Evaporator coils shall be furnished with a thermostatic expansion valve.
   e. Evaporator coils shall be furnished with a double sloped stainless steel drain pan for the positive drainage of condensate.
   f. A drain connection shall be provided on each side of the unit. The manufacturer shall provide a P-trap condensate drain fitting for field installation to the drain connections.
9. Refrigeration System:
   a. Compressors shall be scroll type with internal thermal overload protection and mounted on the compressor manufacturer's recommended rubber vibration isolators. Each compressor shall have independent refrigerant circuits.
   b. Compressors shall be mounted in an isolated compartment to permit operation of the unit without affecting air flow when the door to the compartment is open.
   c. Compressors shall be isolated from the base pan and supply air to avoid any transmission of noise from the compressor into the building area.
   d. System shall be equipped with thermostatic expansion valve type refrigerant flow control.
   e. System shall be equipped with automatic reset low pressure and manual reset high pressure refrigerant controls.
   f. Unit shall be equipped with Schrader type service fittings on both the high side and low pressure sides of the system.
   g. Unit shall be equipped with refrigerant liquid line dryers.
   h. Unit shall be fully factory charged with refrigerant.
   i. Hot gas bypass shall be provided on all refrigerant circuits.
   j. Each compressor shall be individually staged for capacity control.
   k. All circuits shall be equipped with liquid line sight glasses.
   l. Unit shall be equipped with a 5 minute anti-short cycle delay timer for each stage.
   m. Unit shall be equipped with 20 second between stage delay timers for each stage.
10. Gas Heat Section:
   a. Unit shall heat using natural gas fuel and with a minimum four stages of heat capacity.
   b. Unit shall be provided with a gas heating furnace consisting of an aluminized steel heat exchanger with multiple concavities, an induced draft blower and an electric pressure switch to lockout the gas valve until the combustion chamber is purged and combustion air flow is established. Drum type heat exchangers or heat exchanger tubes with separate internal turbulators are not acceptable.
   c. Unit shall be provided with a gas ignition system consisting of an electronic igniter to a pilot system, which will be continuous when the heater is operating, but will shut off the pilot when heating is not required.
   d. Unit shall have gas supply piping entrances in the unit base for through the curb gas piping and in the outside cabinet wall for across the roof gas piping.
   e. The gas heat exchanger shall carry a 15 year non pro-rated warranty.

11. Controls: Programmable thermostat.
12. Smoke Detector:
    a. Unit shall be provided with a smoke detector (Notifier #FSD-751P, CSFM #3240-0028:205) sensing in the supply air portion of the unit wired to shut off the unit control circuit for the supply air fan and to alert the Fire Alarm System.
13. Power:
    a. Unit shall be provided with a factory installed and wired internal disconnect.
    b. Unit shall be provided with phase and brown-out protection to shut down all motors in the unit if the phases are more than 10% out of balance on voltage, or the voltage is more than 10% under design voltage or on phase reversal.
14. Curb:
    a. Curb shall be constructed of insulated galvanized steel. Curbs are to be fully gasketed between the curb top and unit bottom with the curb providing full perimeter support, cross structure support and air seal for the unit. Curb gasketing shall be furnished within the control compartment of the slab mounted unit to be mounted on the curb immediately before mounting of the slab mounted unit. Curb shall be 36 inches high and include horizontal supply duct connection, return duct connection and turning vanes within curb.

L. Evaporative Coolers:
1. Heavy-duty type, with epoxy coated galvanized steel construction.
2. Furnish centrifugal blower with performance certified in accordance with AMCA 210 test procedures, pump (with transformer when required), and 6 position rotary wall switch.
3. Provide level adjustment on distribution trough.
4. Use resilient mounts on motor.
5. Manufacturer: Essick/ Champion, Arvin, Arctic Circle, Adobe Air/ Alpine, Champion or approved equal.

M. Evaporative Coolers Direct/Indirect:
1. Heavy-duty type with epoxy coated galvanized steel construction.
2. Furnish centrifugal blower with performance certified in accordance with AMCA 210 test procedures, pump, bleed off kit, and 2-speed motor.
3. Provide level adjustment on distribution trough.
4. Use resilient mounts on motor.
5. Provide Mastercool 2-stage indirect cooling modules quantity as scheduled on drawings. Galvanized steel construction with polyester-epoxy coating. Polystyrene heat exchanger. 5 year warranty.
6. Entire unit with indirect modules shall be field wired for single point electrical connection. Provide all necessary transformers and controls with an external mounted disconnect. The 2 speed motor is provided separately and shall be field installed and wired.
7. Manufacturer: Mastercool or equal.

N. Duct Furnace: Indirect Fired Gas furnace shall be 80% efficient, UL Certified per ANSI Z83.8 - 1996, C.G.A. approved per 2.6 - M96. Furnace shall be capable of operation with natural gas and have a power venting system. The burner and heat exchanger shall be constructed of stainless steel. Standard furnace features shall include pressure switch, main gas valve, electronic staged, electronic intermittent pilot ignition, high limit and a 24-volt control transformer.

O. Evaporative Cooler (Direct):
1. Cabinet & Lower Panels: Constructed from molded high strength structural polymers with built-in telescoping support legs. Breezair or equal.
2. Fan: Double inlet/ width, forward curved centrifugal fan molded in one-piece polypropylene. Stainless steel hollow fan shaft square sectioned for stability.

3. Bearings: Supported in single row radial ball bearings, pre-lubricated and sealed with double routing seals. Adjustable motor pulleys.
4. Safety Features: On board isolation switch, overload circuit breaker protection on pump and motor circuits, thermal protection on water pump and motor.
5. Fan Housing: Molded high strength structural polymer, complete with integral bearing housing.
6. Water System: Non-corrosive plastic float valve. Patented tray style water distribution system can never be blocked.
7. Filter Pads: Takes four Chilled™ 3.5" pads with water distribution header block.
8. Tornado™ Water Pump: Watertight, thermally protected, compartmentalized motor.
9. The Breezair Water manager: Because it monitors water quality electronically, it detects harmful impurities in the water before they build up on cooler pads, thereby reducing cooling efficiency. If the Water Manager detects impurities – such as salt or minerals – it automatically replaces the impure water with pure water. As a result, cooling effectiveness is increased and pads last substantially longer and require less maintenance.
10. Automatic Drain System: Completely eliminates the algae and dirt build-up common to evaporative coolers. The automatic drain enables the Breezair cooler to be completely clean and dry when it's not in use. As a result, maintenance is reduced – odors are eliminated and the air from the cooler is always fresh, clean, and cool.

P. Evaporative Cooler (Indirect):
1. Unit is an indoor or outdoor mounted, electrically controlled cooling and ventilation unit utilizing variable speed, electronically cumulated fans, and indirect evaporative heat exchangers. Coolerado or approved equal.
2. Unit shall be ETL tested and certified in accordance with UL 507, Standard for Safety Electric Fans, 9th Ed and Standard for Fans and Ventilators, CAN/CSA22.2, 7th Ed.
3. Indirect evaporative cooling system shall be ETL tested and certified in accordance with UL900, Safety for Air Filter Units, 2004, Class 2 rating.
4. Indirect evaporative cooling system shall be ETL tested and certified in accordance with ULC-S111, Standard Method of Fire Tests for Air Filter Units, 2007.
5. At full speed, the unit shall be capable of cooling intake air (outside air) to over 94 percent of the wet bulb, dry bulb difference of the intake air (wet bulb approach) without adding any humidity to the product air stream.
6. At 50% of the full rated air volume, the unit shall be capable of cooling the intake air (outside air) to temperatures lower than the incoming air's wet bulb temperature (greater than 100 percent wet bulb approach) without adding any humidity to the product air stream.
7. The conditioned air stream shall not be any less than 55 percent of the volume of the intake air stream.
8. The working air stream shall not be any more than 45 percent of the intake air stream.
9. The system shall be variable speed with a minimum of 20 equally spaced speed settings from no flow to full speed flow.
10. At 95°F dry bulb, 10 percent relative humidity, and downstream pressure losses of 0.3 inches of water column, the system shall have an Energy Efficiency Ratio (EER) greater than 70.
11. Water use shall be less than 2.5 gallons per ton-hour of sensible cooling.
12. General:
    a. Each unit shall be a factory assembled cooling unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, and special features required prior to field start-up.
13. Unit Cabinet:
    a. Constructed of galvanized steel on both sides and coated with a baked thermosetting powder coating finish on all surfaces.
    b. Cabinet panels shall be easily removable for servicing. Cabinet panels are minimum 20 gage.

c. Filters shall be accessible through an access panel.
d. Unit shall contain a sloped drain pan, to prevent standing water from accumulating. Pan shall be fabricated of ABS plastic to prevent corrosion.
e. Unit shall not contain a sump or other device where standing water can accumulate.

14. Fans:
    a. Blower (fan):
        1) Fan shall be direct drive.
        2) Fan wheel shall be made from aluminum or plastic. It shall be a dynamically balanced, single-inlet type with backward-curved blades.
        3) Drive motor shall be electronically cumulated, variable speed.
15. Filter Section:
    a. Standard filter section shall consist of 1 size of factory-installed 2-in. (51 mm) thick throwaway fiberglass filters of commercially available sizes. Filters shall be approximately 10% efficient with an airside pressure drop of approximately 0.1 in. wg (clean).
16. Controls and Safeties:
    a. Unit Controls:
        1) Capacity control (20-step minimum).
        2) Unit shall be complete with self-contained low-voltage control circuit.
    b. Safeties:
        1) Access to electrical and moving parts shall require the use of a tool (screwdriver or similar device).
17. Operating Characteristics: Unit shall be capable of starting and running at 140°F ambient outdoor temperature.
18. Electrical Requirements: All unit power wiring shall enter unit cabinet at a single location.
19. Motors:
    a. All fan motors shall have permanently lubricated, sealed bearings and inherent automatic-reset thermal overload protection.
20. Special Features:
    a. Electronic Programmable Thermostat: Units shall be capable of using deluxe full-featured electronic thermostat that uses proportional and integral logic to determine air conditioner speed based on roof set point temperature and room temperature.

Q. Range Hood:
1. General: Self-contained stainless steel residential style unit designed for indoor installation and UL listed. Factory assembled and tested. Provide with washable aluminum filters, integral controls for multi-speed fan and two (50 watt max.) halogen flood lights. Verify color or stainless steel with Architect/ Owner prior to ordering. Broan or equal.

R. Radiant Heaters:
1. Burner Box:
    a. Natural gas model, burner design with silicone gasketed doors and internally mounted blower, nickel plated steel burner cup, outside air adapter, hot surface ignition, four-try ignition, interlock safety switch, all components easily accessed, durable spot welded construction, mica flame observation window, balanced air rotor, controls are separated from the combustion air stream. Burner assembly shall be epoxy-polyester powder painted for corrosion resistance. Stainless steel flexible gas line and gas shut-off assembly included.
    b. Heater shall be equipped with permanently lubricated motor with thermal overload protection.
2. Burner Controls:
    a. Factory Wired: All burners shall be factory wired for 120 Vac operation, Hot Surface Ignition (HSI), modulating gas valve and control for burner operation

sequencing and modulation control.

b. Fail-Safe Controls: To assure fail-safe operation, design shall include an air proving safety pressure switch to verify blower operation before gas valve opens. Blower air pressure shall be continuously monitored by a pressure sensor. A sensed reduction in pressure shall result in corresponding reduction in gas input for maximum safety and combustion quality.

c. Ignition Controls: All units shall be equipped with a control for ignition sequencing. Ignition shall be fully automatic HSI. The ignition sequence shall have a prepurge and timed trial for ignition with multiple ignition trial before lockout occurs. The heater shall be capable of a minimum of 4 trials for ignition to provide maximum reliability. Heater shall have blower post-purge after burner shutdown. Heater shall have automatic one hour reset from lockout.

d. Modulation Controls: All units shall be equipped with a control board to modulate both gas input and combustion air simultaneously. Heater input shall modulate continuously (not staged) throughout input range from minimum rated input to maximum rated input. Control shall be configurable for modulating burner input by the following methods: automatically by 24V thermostat; or automatically by zone sensor inputs; or directly by remote analog signal; or manually by potentiometer.

e. Zone Control: All units shall be equipped with a control configurable to allow multiple heaters to be connected to a single heat demand control device. No user programming shall be required. Heat demand control device shall be connected to heater configured as a “central” unit. Remaining units in the zone shall be configured as “satellite” units and controlled by the “central” unit via low voltage control wiring.

3. Reflectors: Provide aluminum, or other highly radiant reflective material, installed to provide continuous coverage of heat exchanger. To maximize radiant output and minimize convection losses, reflectors are to extend to the bottom of the heat exchanger pipe.
   a. Cover Elbow Fittings: Provide reflector joint overheat exchanger elbows to provide continuous coverage of heat exchanger.
   b. End Cap Fittings: All reflectors shall have end caps to prevent convective losses.
   c. Side Reflectors: System to have perimeter side extension reflector where specified. Side reflectors permanently attach to standard reflector and secured by three side reflector supports and clips. Tilting of reflectors causes convective loss and will not be acceptable.
4. Outside Air: Provide fresh outside air to each burner for combustion.
5. Heat Demand Control Devices: All units shall be equipped with control configurable to allow a variety of heat demand control options. Control options shall include 24V thermostat, zone temperature sensor, 0-10vdc, 4-20mA and manual potentiometer. Provide where indicated, low voltage type heat demand control device for each “central” radiant heater. One of the five options below shall be specified by the engineer.
   a. 24V Thermostat: Control shall provide 24V for thermostat power. Programmable or manual thermostats may be used. Thermostat shall be wired only to one heater per zone designated as the “central” heater. Modulation control signal shall be wired in series from “central” heater to each “satellite” heater in the zone via control wiring. Separate ON/OFF switch optional for “satellite” heaters (not supplied by manufacturer).
   b. Zone Temperature Sensor: Shall include 40-75ºF setpoint adjustability and low voltage ON/OFF switch as available from radiant heater manufacturer. Suitable for mounting on a standard 4 x 2 junction box. Temperature sensor shall be wired only to one heater per zone designated as the “central” heater. Modulation control signal shall be wired in series from “central” heater to each “satellite” heater in the zone via control wiring. Separate ON/OFF switch optional for “satellite” heaters (not supplied by manufacturer).
   c. 0-10vdc Signal: Shall be provided by an external controller, not supplied by radiant

heater manufacturer. Signal will provide direct control of heater input rate. Signal shall be wired only to one heater per zone designated as the “central” heater. Radiant heater manufacturer shall supply signal value vs. heater input details. Installer shall provide low voltage ON/OFF switch at user level for each “central” heater. Modulation control signal shall be wired in series from “central” heater to each “satellite” heater in the zone via control wiring. Separate ON/OFF switch optional for “satellite” heaters (not supplied by manufacturer).

d. 4-20mA Signal: Shall be provided by an external controller, not supplied by radiant heater manufacturer. Signal will provide direct control of heater input rate. Signal shall be wired only to one heater per zone designated as the “central” heater. Radiant heater manufacturer shall supply signal value vs. heater input details. Installer shall provide low voltage ON/OFF switch at user level for each “central” heater. Modulation control signal shall be wired in series from “central” heater to each “satellite” heater in the zone via control wiring. Separate ON/OFF switch optional for “satellite” heaters (not supplied by manufacturer).

e. Manual Potentiometer (10k Ohm) Control: Must be linear 10,000 Ohm (three-wire control) potentiometer. Potentiometer dial position shall dictate heater input rate. Shall provide “MIN to MAX” burner input adjustability. Installer shall provide low voltage ON/OFF switch at user level, at or near potentiometer unit. Potentiometer shall be wired only to one heater per zone designated as the “central” heater. Modulation control signal shall be wired in series from “central” heater to each “satellite” heater in the zone via control wiring. Separate ON/OFF switch optional for “satellite” heaters (not supplied by manufacturer).

6. Radiant Tube - Heat Exchanger:
   a. Radiant Tube shall be 4 in. O.D. Heat Treated Aluminized steel tube x 16-gauge wall with an emissivity factor of 0.80 or greater. Hot rolled steel tubing shall not be used.
   b. Burner Tube: shall be ALUMI-THERM® steel (aluminized steel/titanium alloy) tube for the first 10 ft. of each radiant heater.
   c. Hanging Materials: Heat exchanger must be supported in accordance with acceptable practices, local codes, seismic requirements, and applicable standards and as shown on plans. Heat exchanger tube shall pitch down at least 1/2 inch in 20 ft. on radiant tube, away from burner box.

S. Wall Mount Heat Pump:
   1. General: Self-contained cooling unit designed for outdoor installation. Factory assembled and tested. Provide all starters and relays required for operation. 24 volt control circuit from integral transformer. Weatherproof cabinet, galvanized steel with enamel finish. Drain pan. Multi-vane-centrifugal supply fan. ARI certified. Bard, Marvair or approved equal.
   2. Refrigeration: Sealed Hermetic compressor with internal vibration isolating mount. Reversing valve, hard start components, crankcase heater, high/low pressure switch, anti-recycle timer. Air-cooled condenser with propeller fan. Non-ferrous finned coil. Low ambient control to 25°F, unless otherwise noted.
   3. Guarantee: Provide 5 year extended warranty on the condenser coil and compressor.
   4. Thermostat: Thermostats shall comply with Title 24 Energy Conservation Standards. Thermostat shall provide automatic changeover from heating to cooling with continuous fan operation. Provide 2 stage heating and "OFF-HEAT-AUTO-COOL" and "AUTO-ON" switches.

T. Energy Recovery Units:
   1. General: Energy Recovery Ventilator shall be as manufactured by “Greenheck” or approved equal, Units shall be listed per ANSI/UL 1995, Heating and Cooling Equipment. Energy transfer ratings shall be ARI Certified. Ventilators shall bear the AMCA Certified Rating Seals for air performance. Performance shall be as scheduled on plans. Outdoor air shall not mix with exhaust air in a common plenum. Exhaust

discharge and outside air intake shall not be located on the same side on roof top units.

2. Unit Casing and Frames: Unit shall be of internal frame type construction of galvanized steel. Frame and panels shall be G90 galvanized steel. All panels exposed to the weather shall be a minimum of 18 gauge galvanized steel. Where top panels are joined there shall be a standing seam to insure positive weather protection. All metal-to-metal seams shall be sealed, requiring no caulking at job site. Baked enamel finish for all exterior parts. Unit base to be designed for curb mounting. Unit base shall overhang the curb for a positive seal against water run-off.
3. Weatherhoods: Weatherhoods shall be of the same finishes the unit. Outdoor air weatherhood shall incorporate a louvered design and moisture eliminator. Weatherhoods shall be tested in accordance with AMCA Standard 500-L to prevent water penetration up to 3 in/hr at 29 mph. Moisture eliminator shall be aluminum, consisting of corrugated mesh to eliminate water penetration into unit.
4. Insulation: Unit casing to be insulated with 1 inch – 3 lb. fiberglass with Foil-Scrim-Kraft facing. Insulation shall be in accordance with NFPA 90A and tested to meet UL 181 erosion requirements and secured to unit with waterproof adhesive and permanent mechanical fasteners.
5. Energy Recovery Wheel: Wheel shall be of the enthalpy type for both sensible and latent heat recovery and be designed to ensure laminar flow. Energy transfer ratings must be ARI Certified to Standard 1060 and bear the ARI Certification symbol for ARI Air-to-Air Energy Recovery Ventilation Equipment Certification Program based on ARI 1060. Desiccant shall be silica gel for maximum latent energy transfer. Wheel shall be constructed of lightweight polymer media to minimize shaft and bearing loads. Polymer media shall be mounted in a stainless steel rotor for corrosion resistance. Wheel design shall consist of removable segments (for wheels greater than 26 in. diameter) for ease of service and/or cleaning. Silica gel desiccant shall be permanently bonded to wheel media to retain latent heat recovery after cleaning. Wheels with sprayed on desiccant coatings are not acceptable. Wheels with desiccant applied after wheel formation are not acceptable. Energy recovery device shall transfer moisture entirely in the vapor phase. Energy recovery drive belt material shall be high strength urethane and shall be factory installed in a pre-stretched state, eliminating the need for field belt tension adjustment. Link style belts are not acceptable.
6. Access Doors: All components shall be easily accessible through removable doors for exhaust, supply, filter, and damper compartments. Energy recovery wheels (smaller than 54 inches) shall be mounted in a slide-out track for ease of inspection, removal, and cleaning.
7. Fan Sections: Centrifugal fans to be double width, double inlet, single fan forward curved type. All blower wheels shall be statically and dynamically balanced. Ground and polished steel fan shafts shall be mounted in permanently lubricated, sealed ball bearing pillow blocks. Bearings shall be selected for a minimum (L10) life in excess of 100,000 hours at maximum cataloged operating speeds. Separate motors for exhaust and supply blowers shall be provided. Adjustable sheaves on belt-driven fans with motors less than 10 hp shall allow independent balancing of exhaust and supply airflows. Optional speed controllers on direct-drive fans shall allow independent balancing of exhaust and supply airflows. Fan and motor assemblies are mounted to unit base with neoprene isolators as standard. Fans shall be located in draw through position in reference to the energy recovery wheel.
8. Motors and Drives: Motors shall be energy efficient, complying with EPACT standards, for single speed ODP and TE enclosures. Motors shall be permanently lubricated, heavy-duty type, matched to the fan load and furnished at the specified voltage, phase, and enclosure. Belt drive motors shall be factory mounted to an adjustable motor plate having two heavy duty adjusting bolts for alignment and belt tension. Drives shall be sized for a minimum of 150% of driven horsepower. Pulleys shall be of the fully machined cast type, keyed and securely attached to the fan wheel and motor shafts; 10 horsepower and less shall be supplied with an adjustable drive pulley. Energy

wheel motors and direct drive motors shall have integral overload protection.

9. Filters: Supply and exhaust air filters shall be 2 inch thick pleated fiberglass, 30% efficient and tested to meet UL Class 2. Filter racks shall be die formed galvanized steel.
10. Electrical: All internal electrical components shall be factory wired for single point power connection. All electrical components shall be UL Listed, Approved or Classified where applicable and wired in compliance with the National Electrical Code. For Model ERV-251, weatherproof, integral door interlocking disconnect switch and terminal strip shall be supplied as standard components in the control center. Optional features include motor contactors, 24 VAC control circuit, and fusing. For Models ERV-361 and above, weatherproof, integral door interlocking disconnect switch, motor starters, control circuit fusing, and control transformer for 24 VAC circuit shall be supplied as standard components in the control center. Motor starters consist of a contactor and Class 20 adjustable overload protection and shall be provided for all motors in the unit.

OR

U. Energy Recovery Units:

1. General: Energy Recovery Ventilator shall be as manufactured by “Renewaire” or approved equal. Units shall be HVI Certified. Ventilators shall be UL Listed. Performance shall be as scheduled on plans. Outdoor air shall not mix with exhaust air in a common plenum.
2. Unit Casing and Frames: Unit shall be of internal frame type construction of galvanized steel. Frame and panels shall be 20 GA steel. All metal-to-metal seams shall be sealed, requiring no caulking at job site. Baked enamel finish for all exterior parts.
3. Access Doors: All components shall be easily accessible through removable doors for exhaust, supply, filter, and damper compartments.
4. Fan Sections: Continuous duty, permanently lubricated motors. 36” power cord provided.
5. Filters: Supply and exhaust air filters shall be 30 ppi washable reticulated foam.
6. Electrical: All internal electrical components shall be factory wired for single point power connection. All electrical components shall be UL Listed, Approved or Classified where applicable and wired in compliance with the National Electrical Code.

V. Gas Unit Heaters:

1. General: The units shall be AGA certified. Reznor, Modine, Roberts Gordon or equal.
2. Heat Exchanger: Stainless steel construction, separated combustion with vertical or horizontal venting and concentric vent kit.
3. Casing: 18-gauge steel with threaded pipe connections for hanger rods.
4. Finish: Factory apply baked finish.
5. Fan: Direct drive propeller type, statically and dynamically balanced, with fan guard: Horizontal models with permanently lubricated sleeve bearings; vertical models with grease lubricated ball bearings.
6. Air Outlet: Adjustable pattern diffuser.
7. Motor: Horizontal models with permanently lubricated sleeve bearings; vertical models with grease lubricated ball bearings.
8. Control: 24-volt transformer, intermittent safety pilot. Provide 7-day programmable thermostat.
9. Capacity: Based on 65°F entering air temperature. See drawing for capacity.

PART 3 EXECUTION

3.1 DUCTWORK INSTALLATION

A. General:

1. Standards: Unless otherwise noted, all ductwork shall be constructed and installed in accordance with current SMACNA "HVAC Duct Construction Standards". Ductwork and accessories shall be installed in a manner to prevent vibration and rattling.
2. Seismic Bracing: All ducts shall be braced and supported per details on the drawings.
3. Duct Access Doors: Provide access doors as required to adjust equipment and dampers.
4. Flexible Connections: Connections of ductwork to all equipment shall be with 6" (min.) flexible connection. Install with ample slack and uniform gap after deflection of vibration isolators. There shall be no metal to metal contact across flexible connection. Protect outdoor connections with weatherproof metal shroud on top and sides, no metal-to-metal contact. Provide at all seismic joints.
5. Ducted Returns: All air handling that is not directly located in the space that it serves shall have ducted returns.
6. Open ends of ductwork shall be covered during construction to keep inside clean.

B. Low Velocity-Low Pressure (up to 2000 ft/ min; up to 2.0 in. water):
1. Sheet Metal Ductwork:
   a. Ells: Ells with less than standard radius and square ells shall be fitted with turning vanes.
   b. Tees: Tees shall be straight tap-in with extractor or 45 degree takeoff, as shown on drawings.
   c. Duct Joints: Seal duct joints airtight with fiber tape and adhesive per manufacturer's printed instruction. Ducts in weather shall be sealed air and watertight with duct mastic before closing and taping.
      1) Where Ductmate type joints are used, the manufacturer's designated procedure shall be followed. Ductmate joints on roof shall have continuous cleat on top duct flange to prevent water from collecting on gasket.
   d. Dampers: Install volume control damper and damper regulator in all branch ducts.
   e. Duct dimensions shown on drawings for lined ducts, are clear net openings inside of lining.
   f. Top of ducts exposed to weather shall be cross broken and sloped slightly to each side to allow rainwater to run off. Ducts that do not drain off top will be rejected and need to be replaced at contractors' expense.
2. Flexible Glass Fiber Ductwork: Hangers shall be 2" wide metal straps spaced to prevent sagging, 3 feet spacing maximum. Insert 6" wide fiberglass pad between duct and hanging strap. All joints and fittings shall be sheet metal and shall be installed with metal bands or 3 (min) self-tapping screws and fiber tape. Maximum length of flexible duct shall be 5 ft. Single piece minimum length shall be 3 ft. Minimum turn radius shall be in accordance with SMACNA Standards (turn radius to duct centerline not less than 1.5 times the duct diameter).

3.2 AIR TERMINALS AND DUCT FITTINGS INSTALLATION

A. General: Unless otherwise noted, all air terminals and duct fittings shall be installed in accordance with current SMACNA "HVAC Duct Construction Standards", details on drawings and manufacturer's instructions. Terminals and fittings shall be installed in a manner to prevent vibration and rattling.

B. Fire Smoke Damper: Fire smoke dampers shall be installed in accordance with their State Fire Marshal approval and the manufacturer's recommendations.

C. Gym: Attach safety cable to inside of duct and to grille neck with #10 sheet metal screws.

3.3 DUCTWORK INSULATION INSTALLATION

A. General: All supply and return sheet metal ductwork shall be insulated.

B. Concealed Ductwork: Wrap ductwork with fiberglass blanket lapped 2" minimum. Secure with foil tape at all joints for a complete vapor barrier.

C. Acoustic Lining: All ductwork in equipment rooms, where exposed to weather, and elsewhere as indicated on drawings, shall have acoustic lining. Increase each sheet metal dimension to accommodate lining and maintain clear inside duct dimensions shown on drawings. Apply lining with bonding adhesive in accordance with manufacturer's recommendations and secure with mechanical fasteners in accordance with SMACNA Standards. Seal exposed edges of lining with bonding adhesive.

3.4 PIPING INSTALLATION

A. General:
1. Piping Layout: Piping shall be concealed in walls, above the ceilings, or below grade unless otherwise noted. Exposed piping shall run parallel to room surfaces; location to be approved by Architect. No structural member shall be weakened by cutting, notching, boring or otherwise unless specifically allowed by structural drawings and/ or specifications. Where such cutting is required, reinforcement shall be provided as specified or detailed. All piping shall be installed in a manner to ensure unrestricted flow, eliminate air pockets, prevent any unusual noise, and permit complete drainage of the system. All piping shall be installed to permit expansion and contraction without strain on piping or equipment. Expansion joints and/or flexible connectors shall be installed as required. Vertical lines shall be installed to allow for building settlement without damage to piping. Lines shall be adequately braced against vertical and lateral movement.
2. Pipe Support:
   a. General: Hangers shall be placed to support piping without strain on joints or fittings. Maximum spacing between supports shall be as specified below. Actual spacing requirements will depend on structural system. Refer to drawings for additional requirements and attachment to structure. Vertical piping shall be supported at floor and ceiling. Support pipe within 12" of all changes in direction. No perforated straphanger shall be used in any work.
   b. Refrigerant Piping: Pipe shall be cut square. Joint surfaces shall be thoroughly cleaned, fitted, and erected before brazing. Install specified accessories. After installation, evacuate to 29 inches of mercury, ambient temperature during evacuation shall not be less than 70 degrees F. After evacuation, fill with dry nitrogen to 250 psi and maintain for two-hour period without additional charge. After nitrogen test, purge with refrigerant charged through dryer and maintain holding charge in system and equipment. Refrigerant piping below grade shall be run in 4” (min.) PVC conduit with long radius ells. Seal ends of conduit watertight.
   c. Flue Piping: Flue piping shall be installed in accordance with its UL listing and manufacturer's instructions. All welders shall be certified in accordance with AWS Standard D9.1, Specifications for welding sheet metal.
   d. PVC Piping: Shall be cut square and assembled prior to solvent weld. Apply primer per manufacturer’s recommendations. Coat male joint fully with solvent, make joint before solvent dries and wipe exterior clean.

3.5 PIPING INSULATION INSTALLATION

A. Refrigerant Piping: Cover suction piping with foamed plastic insulation. Longitudinal and end seams shall be thoroughly cemented with adhesive in accordance with manufacturer's recommendation. Cover all fittings, unions, valves, and connections. Piping exposed to weather shall be covered with aluminum jacketing, seal all joints and seams with grey outdoor mastic or silver silicone sealant. Piping exposed in room shall be covered with piping chase painted to match wall.

3.6 EQUIPMENT INSTALLATION

A. General: It shall be the responsibility of the contractor to ensure that no work done under other specification sections shall in any way block, or otherwise hinder access panels or diminish the effectiveness of equipment vibration isolation.

B. Connections to Equipment: Where size reductions are required for connections to equipment, they shall be made immediately adjacent to the equipment and, if possible, inside the equipment cabinet. Connections made to equipment mounted on vibration isolators shall be with flexible connectors, installed adjacent to equipment.

C. Start Up: Engage manufacturer or factory-authorized service representative to perform start up supervision. Manufacturer shall provide on-site start up and commissioning assistance through job completion. Complete installation and start up checks according to manufacturer's written instructions.

3.7 TEMPERATURE CONTROL SYSTEM

A. Thermostats shall have the capability of terminating all heating at a temperature of no more than 70 degrees F or terminating all cooling at a temperature of no less than 78 degrees F, and to provide a temperature range of up to 10 degrees F between full heating and full cooling. Thermostats shall be 7 day programmable, Carrier, Robertshaw or equal with sub-base capable of battery backup or capacitor to retain program in the event of a power outage. All control wiring, regardless of voltage, shall be installed in conduit.

3.8 HVAC DUCT CLEANING

A. General: Duct cleaning procedures shall be done per National Air Duct Cleaners Association (NADCA), ACR 2006 Guidelines. Contractor shall thoroughly clean all existing ductwork and grilles to remain shown on drawings with a brush and vacuum system. All workers who may potentially breathe duct contaminants or biocides should wear suitable protective breathing apparatus. Also, workers should look for other types of problems, such as holes or gaps in the ducts. After duct cleaning, a video inspection shall be done for owner review. Inspector to be present during video inspection. The video shall be performed on all ductwork runs with adequate lighting at the camera and adequate reference point, grilles, etc.

B. Work Schedule: All work shall be performed in accordance with the time provisions of the contract. Contractor shall perform work according to a pre-approved schedule with General Contractor, and to complete the work on schedule.

C. Power Vacuum Equipment: Vacuum shall be equipped with final High efficiency Particulate Efficiency (HEPA) filtration to protect surrounding environment from recontamination by disbursement of contaminants removed from air ducts. As an option, contractor may use a collection unit outside of the building. It shall be the contractor's responsibility to remove and dispose of all contaminants from jobsite at contractor's expense.

D. Supervision: All work shall be supervised by an on-site skilled foreman with thorough knowledge and experience in the cleaning of heating, ventilating and air conditioning systems. Supervisor shall have a minimum of 5 years' experience in duct cleaning.

E. Cleaning Process: All ducts shall be cleaned and inspected as work proceeds. Ductwork shall be cleaned by attachment of HEPA power vacuum hose to isolated section of air duct and by combining brushes and reverse air nozzles, to remove all contaminants from the surface of air duct interior. As the brushes and reverse air nozzle are being operated, all

contaminants shall be drawn into the HEPA vacuum unit (minimum 5,000 CFM HEPA vacuum to maintain velocity necessary to keep particulate airborne – 3500 FPM). All foreign materials such as dust, mold, soot, lint, bacteria, and other air residues shall be removed from air ducts. Fan powered high efficiency dust and particulate collection units shall be connected to the supply outlets. The collection systems shall be a self-contained unit, with appropriate components to adequately prevent dirt and debris, loosened from upstream ducts during cleaning operations, from entering the conditioned spaces by capturing this debris within the collection device.

1. Special care and attention shall be given to air ducts having interior lining and a light vacuum process shall be used to prevent damage to air side surfaces. All loose fibrous materials shall be removed by a combination of controlled air pressure and power vacuum.
2. Any major repairs not included in contract shall be brought to the owner's attention.
3. The air handling unit should not be used during the cleaning process. Also, after duct cleaning has been completed, the air handler should be run one (1) hour to allow at least 8 air changes in the area cleaned before being occupied.
4. When gaining access to sheet metal ducts for cleaning use existing duct systems openings where possible. However, where holes need to be cut for access it is essential to seal the access hole properly in order to maintain the integrity of the HVAC system.

F. Clean Up: Contractor shall, at the end of each shift, remove all waste, dirt, and debris, resulting from work performed. Such materials shall be removed from the property and disposed of at the expense of the contractor.

G. Place filter media in all supply diffusers to ensure no contaminants are emitted into areas during cleaning.

H. Cut access panels where necessary by use of sheet metal cutting devise. Access into supply side, then cover with 24 gauge metal gasket seal. Apply sheet metal screws for an airtight seal. Where necessary in concealed attic spaces Contractor will install ceiling access points. Provide gasketed removable access panels at the following locations:

1. Adjacent to turning vanes.
2. Adjacent to dampers (balancing, fire, control, back-draft, splitter, etc.).
3. Upstream of VAV boxes.
4. Next to duct transitions, offsets, and changes of direction.
5. Adjacent to all other in-duct mechanical components and sensors.

I. At any time when ducts are large enough Contractor will enter the ductwork to clean by hand.

J. Wherever the grilles and/ or diffusers are removable, they shall be removed, vacuum cleaned, washed, dried, and then replaced at the original setting. Welded grilles may be cleaned in place.

K. Sanitizing the air distribution network shall be performed as required. Using a suitable atomizing spray wand inserted through the access points, coat all interior surfaces of the ductwork with a fine mist of an EPA registered sanitizing fluid: Oxine or equal.

L. Where necessary place plastic covers on all office furnishings and equipment to protect it from dirt and debris.

M. Supply color codes on blueprints to indicate work performed during the last shift.

N. Supply progress report to the Engineer on work completed and work to be performed on a

shift by shift basis.

O. Supply M.S.D.S. sheets on all cleaners that are used in the cleaning process.

3.9 SYSTEM AIR BALANCE

A. Scope: Provide services necessary to initially deliver the air quantities shown on the plans and finally to balance for uniform temperature in the spaces served. Adjust all elements in grilles and diffusers for proper air distribution and to minimize drafts. Submit final Air Balance Report for approval before final completion of the construction contract. Comply with SMACNA manual for the balancing and adjustment of air distribution systems.

B. As a minimum, the balance report shall include CFM and neck size at each supply, return and exhaust grille, total CFM and external static pressure for all air moving equipment, and name plate and actual motor amps for indoor air fans.

C. As a part of the work of this contract, THIS DIVISION shall make any changes in the pulleys, belts, and dampers or the addition of dampers required for correct balance as recommended by air balance agency, at no additional cost to Owner.

OR

D. Scope: Provide the services of a qualified independent test and balance agency certified by the Associated Air Balance Council (AABC) or The National Environmental Balancing Bureau (NEBB) to test, adjust and balance, retest, and record performance of the system to obtain design quantities as specified. Balancing contractor must also be TABB certified and have a C-20 license.

E. Qualifications: Prior to commencing work, the agency shall be approved by the Owner's Representative.

F. Instruments: All instruments shall be accurately calibrated; calibration histories shall be available for examination. Application of instrumentation shall be in accordance with AABC standards.

G. Procedure: General: Balanced quantities shall be plus 5%, minus 5% of design quantities. All name-plate data, manufacturer, model, and serial numbers shall be recorded for each item tested.

H. Extended Warranty: The test and balance agency shall include an extended warranty of 90 days after completion of test and balance work, during which time the Owner's Representative at his discretion may request a recheck or resetting of any item or items in test report. The agency shall provide technicians to assist the Owner's Representative in making any tests he may require during this period of time.

I. Air Balance Procedure (for each Air Handling System):
1. All air filters shall be clean when air balance is performed.
2. Provide a sketch of the equipment showing exactly where all pressure readings were taken.
3. Adjust blower RPM to design requirements.
4. Record motor full load amperes.
5. Make pitot tube traverse of main supply and return ducts and obtain design CFM at fans.
6. Record system static pressures, inlet, and discharge.
7. Record filter quantity, size(s) and pressure drop across filter(s) at each filter bank.

8. Adjust system for design CFM recirculated air.
9. Adjust system for design CFM outside air.
10. Record entering air temperatures. (DB heating, DB and WB cooling.)
11. Record leaving air temperatures. (DB heating, DB and WB cooling.)
12. Adjust all main supply and return air ducts to design CFM.
13. Adjust all zones to design CFM, supply, and return.
14. Adjust all diffusers, grilles, and registers to plus 10%, minus 0% of design requirements.
15. Adjust CFM at all exhaust fans, make-up units, etc. (high and low speed, where applicable). Record applicable data from items 1 through 11 above.
16. Each grille, diffuser and register shall be identified as to location.
17. Verify proper diffusion pattern for all ceiling grilles and that all sidewall grilles are set for 5 degrees downward deflection unless otherwise noted. Make a notation of any that are not set properly.
18. Size, type and manufacturer of diffusers, grilles, registers, and all tested items shall be identified and listed. Manufacturer's ratings shall be used to make required calculations on all items.
19. Readings and tests of diffusers, grilles, and registers shall include required FPM velocity and test resultant velocity, required CFM and test resultant CFM after adjustments.
20. In cooperation with the control manufacturer's representative, set adjustments of automatically operated dampers to operate as specified. Testing agency shall check all controls for proper calibrations and list all controls requiring adjustment by control installers.
21. All diffusers, grilles and registers shall be adjusted for required air patterns and to minimize drafts.
22. As a part of the work of this contract, THE AIR CONDITIONING CONTRACTOR shall make any changes in pulleys, belts, dampers, or the addition of dampers cleaning of insect screens and replacement of filters required for correct balance as recommended by air balance agency, at no additional cost to Owner.
23. Set, test, and adjust packaged heating/ cooling unit economizer operation in cooperation with controls contractor. Record minimum and maximum outside and exhaust airflows.

J. Water Balance Procedure:
1. Set valves for maximum coil flow.
2. Remove and clean all strainers.
3. Examine water in system and determine if water has been treated and cleaned.
4. Check expansion tanks to determine that they are properly charged, and that the system is completely full of water. Bleed air from system.
5. Adjust water flow through boilers, to design flow.
6. Record leaving and return water temperatures at boiler. Reset to correct design temperature.
7. Record the following at each coil:
   a. Inlet water temperatures.
   b. Leaving water temperatures.
   c. Pressure drop across coil.
   d. Pressure drop across bypass valve.
8. Record pump suction and discharge pressures at operating condition and with pump discharge valve completely closed.
9. Record running amperage of pump motor at operation condition and with pump discharge valve completely closed.
10. Record water metering device readings.

K. Test, adjust, and retest water bleed rates from evaporative coolers. Record all data.

L. Acoustic Performance Testing: Provide acoustic performance testing in accordance with the requirements of EQ3.0 of the "California Criteria for High Performance Schools, Best Practices Manual, 2009 Edition".

1. Maximum Background Noise Level: Unoccupied classrooms must have a maximum background noise level of no more than 45 dBA LAeq. The standard anticipates two primary noise sources, steady HVAC equipment noise and the usually unsteady exterior environmental noise. Where the measured ambient noises due to sources other than HVAC are within 5 dB of the measured overall noise (HVAC and exterior intrusive noise) a measurement of at least ½ hour duration shall be made in at least two classrooms in each building in the worst case (noisiest) locations on the school site during normal school days and hours.
   a. To evaluate the significance of intrusive exterior noise, a 30-minute Equivalent Sound Level (LAeq30, in general conformance with ANSI S12.60-2002, Annex E3) measurement shall be made in the classroom that is subjectively assessed to represent the worst case exposure to exterior noise, with the HVAC system not in operation. This Leq30 measurement shall be repeated with the HVAC in operation. If the second "HVAC-on" sound level is more than 5 dB greater than the initial "HVAC-off" measurement, exterior noise intrusion shall be deemed "not significant".
   b. Where intrusive exterior noise has been deemed "not significant" short-term (15 second) A-weighted sound level measurements shall be made in each classroom with the HVAC systems in operation. Where exterior intrusive noise has been deemed "significant" (per the evaluation method noted above), LAeq30 sound level measurements shall be made in each classroom with the HVAC system in operation. In either case, where classrooms are served by variable-air-volume systems, the systems shall be operated at maximum nominal flow (typically by means of varying the thermostat set point).
   c. Where exposure to exterior noise varies significantly between groups of classrooms (e.g. one side of a classroom wing adjacent to a street, the other side facing away), separate evaluations of exterior noise significance can be conducted to limit the need for LAeq30 measurements.
2. Maximum Reverberation: Classrooms less than 10,000 cubic feet must have a 0.6-second maximum (unoccupied) reverberation time and classrooms with volumes between 10,000 cubic feet and 20,000 cubic feet must have a 0.7-second maximum (unoccupied, furnished, and fitted-out) reverberation time. (ANSI Standard S12.60-2002). The reverberation times shall be measured in each classroom in three octave bands with center frequencies of 500, 1000, and 2000 Hz. The arithmetic average of the three measured values shall be compared to the standard.

END OF SECTION 23 00 01

SECTION 26 05 00 COMMON WORK RESULTS FOR ELECTRICAL

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section Includes:
1. Materials and equipment shall be furnished and installed in support of electrical work described in these plans and specifications including but not limited to, raceways, boxes, enclosures, feeders, branch circuiting, supports, terminal cabinets, sleeves, gutters, panels, transformers, switchgear, lighting fixtures, controls, relays, contactors, in order to complete and make fully functional the systems described.
2. Complete fire alarm and annunciation system as shown and/or required by the (local jurisdiction having authority, California State Fire Marshal) including monitoring equipment and wiring for central station connection.
3. Lighting systems, both interior and exterior as shown on the plans and as specified herein, including controls, occupancy sensors, lumen sensors, photocell controls, LED'S supports, fasteners, straps, and miscellaneous mounting hardware and support structures for such equipment.
4. HVAC and plumbing electrical: Conduit, conductors and terminations for all line voltage power, line voltage controls and fusible and/or non-fusible safety disconnect switches for HVAC equipment, including but not limited to air conditioners, furnaces, fans, heat pumps, system pumps, condensing units. Provide protective equipment unless otherwise noted, etc. including protective devices.
5. Power and Lighting Distribution: Furnish and install power and lighting distribution systems including but not limited to panels, feeders, transformers, branch circuits, devices, fixtures, disconnect switches, contactors, controls, etc. for a complete working system.
6. Data systems infrastructure including all boxes, raceways, cable tray, wire basket tray, dedicated branch circuits, sleeves and penetrations, etc. as described and as shown in plans, risers, specifications and/or required for a complete and operating system.
7. Allocation of time to adequately train the Owner on the use and operation of all systems installed within the facility or on the property.

B. System Description:
1. The electrical plans indicate the general layout and arrangement; the architectural drawings and field conditions shall determine exact locations. Field verify all conditions and modify as required to satisfy design requirements as well as code minimums. Maintain all required working clearances as described in CEC Article 110 as well as other applicable articles.
2. Discrepancies shall be brought immediately to the attention of the Architect for clarification. The Architect shall approve any changes. Prior to rough-in, refer to architectural plans that shall take precedence over electrical plans with respect to locations.

C. Related Work Under Other Sections:
1. Mechanical Wiring: Control circuit wiring, energy management controls and interlocks for mechanical equipment shall be installed by Mechanical Contractor.
2. HVAC Control Raceway: Raceways, boxes, and control wiring for thermostats, temperature sensors and control components specified within the mechanical

specifications, shall be furnished and installed as required, and installed in accordance with the minimum wiring methods allowed for branch circuit wiring in Division 26.

3. Smoke Fire Dampers: Coordination with Mechanical plans for exact locations and points of connection for power and fire alarm system connections (power and fire alarm connection shall be by Electrical Contractor).
4. Duct mounted smoke detectors: Coordination with Mechanical plans for exact locations and points of connection for power and fire alarm system connections (power and fire alarm connection shall be by Electrical Contractor).

1.3 SUBMITTALS AND SHOP DRAWINGS

A. Before construction, submit in accordance with the General Conditions of this Specification.

B. Manufacturers' specifications, catalog cuts and shop drawings as required to demonstrate compliance with the specifications. Identify specific intended use for each component where submittal may be ambiguous. Submit entire bound submittal at one time; partial submittals will not be accepted. At a minimum, submittals will be required for the following:

1. Distribution equipment including transformers, distribution panels and breakers, motor controls, distribution and branch circuit panels, grounding, surge protection device, etc.
2. Electrical equipment including disconnects, fuses, raceways, straps and racks, fittings, conductors, boxes, gutters, devices, plates, etc.
3. Lighting equipment including fixtures, LED’s, mounting accessories, color charts (where required), etc.
4. Lighting control equipment including low voltage switching system, dimmer switchbank / accessories, occupancy sensing equipment, time clocks, contactors, photocells, lumen sensors, etc.
5. Complete system component submittals for:
   a. Voice Public Address System / Intercom / Clock.
   b. Fire Alarm System.
   c. Communication Systems including but not limited to; cable, fiber, terminations, cable management, cable tray, patch panels, equipment racks, cabinets, jacks, plates, cable labeling.
6. Conduit including all fittings, etc.
7. Wiring and cable, etc.
8. Fire rating penetration materials, etc.

C. The intent of these specifications is to establish a standard of quality for materials and equipment. Therefore, some items are identified by manufacturer or trade name designation. Substitutions shall be subject to the Architect's approval. Where the substitution will affect other trades, coordinate all changes with those trades concerned and pay any additional costs incurred by them as a result of this substitution. Approval of substitutions shall not relieve the Contractor from providing an operational system in accordance with all applicable codes and ordinances.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Storage of equipment for the job is the responsibility of the Electrical Contractor and shall be scheduled for delivery to the site, as the equipment is required. Damage to the equipment delivered to the site or in transport to the job shall be the responsibility of the Electrical Contractor.

PART 2 PRODUCTS

2.1 MATERIALS

A. Materials shall be new and bear the label of or be listed by a nationally recognized testing laboratory. The quality and suitability of all materials shall conform to the standards and practices of this trade.

B. Supplied materials shall be of a current manufactured product line. Discontinued products are not acceptable. Where products are identified on the contract documents by part number, EC may supply the current product model or series which meets the specification and intended use of the specified component.

PART 3 EXECUTION

3.1 INSTALLATION

A. Professionalism and appearance of installations shall be in accordance with accepted practices of this trade. Installation methods shall conform to manufacturers' specifications and recommendations. The Contractor shall man the job with qualified journeymen and helpers in this trade for the duration of the job. It is the Contractor's responsibility to communicate with and keep the job superintendent appraised of changes or clarifications, etc.

B. Employment of any person on any job in the capacity of an electrician is not permitted unless such person has qualified for and holds a valid Journeyman Electrician Pocket Card or General Journeyman Electrician Certificate issued by the State of California Division of Apprenticeship Standards except, Contractor may employ electrical helpers or apprentices on any job of electrical construction, new or existing, when the work of such helpers or apprentices is performed under the direct and constant personal supervision of a journeyman electrician holding a valid Pocket Card accepted by the State of California Division of Apprenticeship Standards:
   1. Each Pocket Card carrying journeyman electrician will be permitted to be responsible for the quality of workmanship for a maximum of one helper or apprentice during any same time period, provided the nature of work is such that good supervision can be maintained and the quality of workmanship is the best, as expected by Owner and implied by the latest edition of the National Electrical Code.

C. Materials shall be installed in accordance with the manufacturers' specification and recommendations. They must conform to the approval AHJ adopted codes and standards, but not less than the 2022 CEC and all applicable codes and standards, including but not necessarily limited to California Code of Regulations Title 24, NFPA, National Electrical Manufacturers Association, ANSI, CBC, and any other adopted ordinances of applicable agencies having jurisdiction.

D. Electrical Contractor shall lay work out in advance in order to avoid unnecessary cutting, chasing, and drilling of floors, walls, ceilings and other surfaces. Work of this nature shall be carefully done so as not to damage work already performed by other trades. Such alterations shall not depreciate the integrity of the structure. Approval for cuts or penetrations in structural members shall be by the Architect.

E. Supporting Devices:
   1. Verify mounting height of all luminaires or items prior to installation when heights are not detailed.
   2. Install vertical support members for equipment and luminaires, straight and parallel to building walls.
   3. Support conduits within 18” of outlets, boxes, panels, cabinets and deflections. Maximum distance between supports not to exceed spacing per CEC.
   4. Securely suspend all junction boxes, pull boxes or other conduit terminating housings

located above suspended ceiling from the floor above or roof structure to prevent sagging and swaying.

5. Provide seismic bracing per CBC requirements for this building location.
6. Supporting Devices: Safety factor of 4 required for every fastening device or support for electrical equipment installed. Support to withstand four times weight of equipment it supports. Bracing to comply with seismic design category as per Structural Engineer.

F. Coordinate work with other trades as required to eliminate any delays during construction. Coordinate changes with other prime contractors to avoid construction conflicts.

G. Engineer's Field Observation: Site visits during construction for field observations and reports will be conducted by electrical engineer when directed by the Architect. A list of items that need to be addressed will be submitted to the Architect for forwarding to the Contractor.

H. Drawings of Record: Provide a full and accurate set of field record drawings marked up in a neat and understandable manner submitted to the Owner Representative, Construction Manager, or Architect upon completion of the work and prior to issuance of a certificate of completion. The drawings shall dimension all electrical facilities including but not limited to underground conduit, vaults, boxes as well as conduit routing scaled to within 12" of actual field conditions and shall be kept up to date reflecting changes or deviations. Electrical facilities shall be accurately drawn on the plan to scale. Refer to the general conditions of these specifications for additional requirements. Record drawings shall be required to identify both horizontal and vertical dimensions to visible and fixed points such as concrete, asphalt, buildings, sidewalks, etc.

I. Identification: Provide engraved laminated plastic nameplates for all switchboards, panelboards, fire alarm terminal cabinets, telephone and cable television backboards, main devices, control panels, time clocks, contactors and safety disconnect switches accurately identifying each device. Labels shall be attached to the equipment by means of screws or rivets. Self-adhering labels will not be acceptable. Refer to Section 26 05 53: Identification of Electrical Systems.

J. Safety: The Electrical Contractor is responsible to maintain equipment in a safe and responsible manner. Keep dead front equipment in place while equipment is energized. Conduct construction operations in a safe manner for employees as well as other work persons or anyone visiting the job site. Provide barriers, trench plates, flags, tape, etc.

K. Guarantees: Equipment and labor shall be guaranteed and warranted free of defects, unless otherwise stated to be more restrictive, for a period of one year from the date of final acceptance by the Owner. A written warranty shall be presented to the Architect at the time of completion prior to final acceptance. Equipment deemed to be damaged, broken or failed should be repaired or replaced at no additional cost to the Owner. Materials or system requiring longer than a one-year warranty as described herein shall be separately warranted in separate letters of guarantee stating the duration of warranty.

L. Operating and Installation Manuals: Provide two copies each of manuals, operating and installation instructions for equipment indicated in submittal packages. Instruct the Owner's representative as to the operation and location of equipment necessary to allow them to operate the facility upon final acceptance. This instruction period shall be prearranged with the Owner's representative prior to occupancy of the facility and the weeks prior to training scheduled.

END OF SECTION 26 05 00

SECTION 26 05 01 – SELECTIVE ELECTRICAL DEMOLITION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of this Contract, including General and Supplementary Conditions and Divisions 01 Specification Sections, apply to this section.

1.2 SUMMARY

A. This section includes:
   1. Electrical demolition.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work shall be as specified in individual sections.

PART 3 EXECUTION

3.1 EXAMINATION

A. Contractor to walk job to observe existing conditions and account for variance as needed.

B. Verify field measurements and circuiting arrangements as shown on drawings.

C. Verify that abandoned wiring and equipment serve only abandoned facilities.

3.2 PREPARATION

A. Disconnect electrical systems as required under this contract.

B. Coordinate work with the District. No demolition work shall begin without the District's approval.

C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, observe provisions of NFPA 70E and CALOSHA, use personnel experienced in such operations.

D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from Owner at least 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area as required.

E. Existing Fire Alarm System: Maintain existing system in service until new system is accepted, or alternate arrangements have been made with owner (e.g. – Fire Watch). Disable system only to make switchovers and connections. Coordinate outages with Owner and local fire service. Notify Owner/Owner's representative at least 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to

maintain service in areas adjacent to work area.

F. Existing Telephone System: Maintain existing system in service until new system is complete and ready for service. Disable system to make switchovers and connections. Notify Owner at least 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

3.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Demolish and extend existing electrical work under provisions of this section.

B. Remove, relocate, and extend existing installations to accommodate new construction.

C. Electrical Contractor is responsible for demolished electrical materials, and shall remove from the site and dispose properly or recycle.

D. Remove abandoned wiring to source of supply.

E. Remove exposed abandoned conduit. Cut conduit flush with walls and floors, and patch surfaces as required to match existing.

F. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets which are not removed.

G. Disconnect and remove abandoned panelboards and distribution equipment.

H. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

I. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.

J. Discarded electrical components and lamps containing hazardous waste (i.e., mercury in fluorescent lamps) shall be disposed of as required by the State Laws and Local Ordinances regarding hazardous materials.

K. Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.

L. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

3.4 INSTALLATION

A. Install relocated and replacement materials and equipment as shown.

END OF SECTION 26 05 01

SECTION 26 05 19 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:
1. Wires and cables.
2. Connectors.
3. Lugs and pads.

B. System Description:
1. Provide wires, cables, connectors, lugs, strain reliefs, racking insulators for a complete and operational electrical system.

1.3 SUBMITTALS

A. Provide product data for the following equipment:
1. Wires.
2. Cables.
3. Connectors.
4. Lugs.
5. Splice Kits.

B. Provide the insulation cable testing report in the project closeout documentation, refer to Closeout Requirements in the General Conditions portion of this specification.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:
1. Confirm to requirements of the CEC, latest adopted version with amendments by local Authority Having Jurisdiction (AHJ).
2. Furnish products listed by UL or other testing firm acceptable to AHJ.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Wires and Cables: General Cable, Okonite, Southwire, or approved equal.

B. Connectors: Burndy, Ilsco, Thomas & Betts, or approved equal.

C. Wire connectors shall be minimum 75 degree centigrade rated and properly sized for the number of conductors being connected, terminated, spliced etc. All above grade connectors shall be solderless lug or plastic wire nut type, screw on, pressure cable type (wire nut or spring nut type), 600 Volt, 105-degree C, with skirt to cover all portions of stripped wires. Connector shall be U.L. rated for number and size of conductors being joined together as a splice.

D. Splices:
1. Branch Circuit Splices: Ideal, Scotch-Lock, 3M, or approved.
2. Feeder Splices: Compression barrel splice with two layers Scotch 23 and four layers of Scotch 33+ as vapor barrier.
3. Screw Terminal Lugs.
4. Kearney Split Bolt.

2.2 WIRES AND CABLES FOR LINE VOLTAGE SYSTEM AND CONTROLS.

A. Wire and Cable Shall Be:
1. Copper, 600 volt rated throughout. Conductors 12AWG to 10AWG, solid or stranded. Conductors 8AWG and larger, stranded.
2. Phase color to be consistent at all feeder terminations; A-B-C, top to bottom, left to right, front to back. Phasing tape shall be permitted on sizes #6 and larger.
3. Color Code Conductors as Follows:

PHASE	208 VOLT	240 VOLT DELTA	480 VOLT
A	Black	Black	Brown
B.	Red	Orange (High Leg)	Orange
C.	Blue	Blue	Yellow
Neutral	White	White	White w/colored strip
Ground	Green	Green	Green
Isolated Ground	Green w/yellow trace	Green w/yellow trace	N/A

4. All conductors shall be copper unless otherwise noted. Minimum size for individual conductors shall be #12 AWG unless otherwise noted. Sizes #8 AWG and larger shall be stranded conductor. Individual conductors shall be insulated with type, XHHW, THW, THHN/THWN 600- volt insulation unless otherwise noted. Control, signal, communication conductors shall be as dictated by the vendor of that equipment or as specified here-in. Proper insulation type shall be used for the proper environmental application (i.e., waterproof, wet location, plenum, temperature rated). If a condition exists where the application is uncertain, contact the Engineer for direction. Contractor is responsible to follow specific cabling requirements described in other sections of this specification relative to various communications and controls systems as well as the respective riser diagrams shown on plans. If a discrepancy occurs, communicate such discrepancy to the Architect and Engineer immediately for resolution.
5. Insulation types THWN, THHN or XHHW. Minimum insulation rating of 90C for branch circuits.
6. Refer to signal and communications specification sections for cable requirements.

2.3 CONNECTORS

A. Copper Pads: Drilled and tapped for multiple conductor terminals.

B. Lugs: Indent/compression type for use with stranded branch circuit or control conductors.

C. Solid Conductor Branch Circuits: Spring connectors, wire nuts, for conductors 12 through 8AWG.

2.4 LUGS AND PADS

A. Ampacity: Cross-sectional area of pad for multiple conductor terminations to match ampere rating of panelboard bus or equipment line terminals.

PART 3 EXECUTION

3.1 INSTALLATION

A. Installation: Conductors shall not be installed until after conduit systems are permanently in place. Use an approved non-hardening type wire pulling lubricant if lubricant is to be used. Maintain all conduits and wire pulls free from foreign material. If due to field conditions, more than a total of 300 degrees of bend are required; a pull box shall be furnished and installed for ease of installation. Said pull boxes must be sized and rated for the appropriate application and must remain easily accessible upon completion of the project (approval of the location shall be obtained from the Architect prior to installation). Show these pullboxes on the field record drawings. Conductors installed in underground raceways on site shall be duct sealed and taped where they exit the raceway to prevent the entrance of foreign material and moisture after the conductors are installed. Proper drainage shall be provided for underground pull and splice boxes.

B. Insulation: Use proper insulation types where temperature and environment are a factor.

C. Labeling: All conductors in panels, switchboards, terminal cabinets, vaults, pull boxes, and junction boxes shall be labeled with tape number markers indicating circuit number and identifying system. All labeling shall be permanent. See Section 26 05 53: Identification of Electrical Systems.

D. All conductors, wiring, cable where installed below floor, slab or underground shall be considered wet locations, and shall be rated accordingly. Non-waterproof cabling is not allowed in any below grade or wet application.

E. Cables routed together in cable tray shall be stacked, organized and tie wrapped together in a neat and workman like manner. Random cable routing is not acceptable.

F. Cable and conductors routed through pull boxes and vaults shall be properly supported. Bend radius of cable or conductor shall not be less than six times the overall cable diameter.

G. Wires and Cables:
   1. Conductor Installation:
      a. Install conductors in raceways having adequate, code size cross-sectional area for wires indicated.
      b. Install conductors with care to avoid damage to insulation.
      c. Do not apply greater tension on conductors than recommended by manufacturer during installation.
      d. Use of pulling compounds is permitted. Clean residue from exposed conductors and raceway entrances after conductor installation.
   2. Conductor Size and Quantity:
      a. Install no conductors smaller than 12AWG unless otherwise shown (e.g. – Fire alarm and communications systems, as defined in their respective specifications sections and/or drawings).
      b. Provide all required conductors for a fully operable system.
   3. Provide dedicated neutrals (one neutral conductor for each phase conductor). Exceptions may only be granted with Electrical Engineer approval.
   4. Conductors in Cabinets:
      a. Cable and train all wires in panels and cabinets for power and control neatly and uniformly. Use plastic ties in panels and cabinets.
      b. Tie and bundle feeder conductors in wireways of panelboards.
      c. Hold conductors away from sharp metal edges.

3.2 FIELD QUALITY CONTROL

A. Tests:
   1. Test conductor insulation on feeders of 400 amp and greater for conformity with 1000 volt megohmmeter. Use Insulated Cable Engineers Association testing procedures. Minimum insulation resistance acceptable is 1 megohm for systems 600 volts and below.
   2. Test Report: Prepare a typed tabular report indicating the testing instrument, the feeder tested, amperage rating of the feeder, insulation type, voltage, the approximate length of the feeder, conduit type, and the measured resistance of the megohmmeter test. Submit report with operating and maintenance manual.

END OF SECTION 26 05 19

SECTION 26 05 26 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section Includes:
   1. Grounding and bonding requirements of electrical installations for personnel safety and to provide a low impedance path for possible ground fault currents as described in CEC Article 250.
   2. “Grounding electrode system” refers to all electrodes required by CEC, as well as including made, supplementary, lightning protection system and telecommunications system grounding electrodes.
   3. The terms “connect” and “bond” are used interchangeably in this specification and have the same meaning.

B. Related Sections:
   1. Section 26 05 00: Common Work Results for Electrical.
   2. Section 26 05 19: Low-Voltage Electrical Power Conductors and Cables.

PART 2 PRODUCTS

2.1 GROUNDING AND BONDING CONDUCTORS

A. Equipment grounding conductors shall be UL 83 insulated stranded copper, except that sizes No. 10 AWG and smaller shall be solid copper. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes No. 4 AWG and larger shall be permitted to be identified per CEC.

B. Bonding conductors shall be ASTM B8 bare stranded copper, except that sizes No. 10 AWG and smaller shall be ASTM B1 solid bare copper wire.

C. Conductor sizes shall not be less than what is shown on the drawings and not less than required by the CEC, whichever is greater.

2.2 SPLICES AND TERMINATION COMPONENTS

A. Components shall meet or exceed UL 467 and be clearly marked with the manufacturer, catalog number, and permitted conductor size(s).

PART 3 EXECUTION

3.1 GENERAL

A. Ground in accordance with the CEC, as shown on drawings, and as hereinafter specified.

B. System Grounding:
   1. Secondary service neutrals: Ground at the supply side of the secondary disconnecting

means and at the related transformers.
2. Separately derived systems (transformers downstream from the service entrance): Ground the secondary neutral.

C. Equipment Grounding: Metallic structures (including ductwork and building steel), enclosures, fire sprinklers, plumbing piping, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits shall be bonded and grounded.

3.2 INACCESSIBLE GROUNDING CONNECTIONS

A. Make grounding connections which are buried or otherwise normally inaccessible (except connections for which periodic testing access is required) by exothermic weld.

3.3 SECONDARY EQUIPMENT AND CIRCUITS

A. Main Bonding Jumper: Bond the secondary service neutral to the ground bus in the service equipment.

B. Metallic Piping, Building Steel, and Supplemental Electrode(s):
1. Provide a grounding electrode conductor sized per CEC between the service equipment ground bus and all metallic water and gas pipe systems, building steel, and supplemental or made electrodes. Jumper insulating joints in the metallic piping. All connections to electrodes shall be made with fittings that conform to UL 467.
2. Provide a supplemental ground electrode and bond to the grounding electrode system.

C. Service Disconnect: Provide a ground bar bolted to the enclosure with lugs for connecting the various grounding conductors.

D. Switchgear, Switchboards, and Motor Control Centers:
1. Connect the various feeder equipment grounding conductors to the ground bus in the enclosure with suitable pressure connectors.
2. For service entrance equipment, connect the grounding electrode conductor to the ground bus.
3. Connect metallic conduits, which terminate without mechanical connection to the housing, by grounding bushings and grounding conductor to the equipment ground bus.
4. Triple Ground Rod: The ground system shall consist of three ground rods, arranged in an equilateral triangular pattern located at least five (5) feet outside of the housekeeping pad. Space 15 feet apart and drive into the earth to a point two (2) feet below finished grade to top of rods. Grounding electrode conductor shall form a continuous loop around rods, and conductor shall be properly bonded to each rod by a fusion weld similar to "Cadweld".
5. Extend grounding electrode conductor from this ground rod(s) to the grounded service conductor (neutral) in the main switchboard at an accessible point on the ground bus per NEC 250-24.
6. Install grounding electrode conductor of 3/0 Copper.

E. Transformers:
1. Exterior: Exterior transformers supplying interior service equipment shall have the neutral grounded at the transformer secondary. Provide a grounding electrode at the transformer.
2. Separately derived systems (transformers downstream from service equipment): Ground the secondary neutral at the transformer. Provide a grounding electrode conductor from bar at the service equipment.

F. Conduit Systems:
1. Ground all metallic conduit systems. All metallic conduit systems shall contain an equipment grounding conductor sized per CEC.
2. Nonmetallic conduit systems shall contain an equipment grounding conductor, except that non-metallic feeder conduits which carry a grounded conductor from exterior transformers to interior or building-mounted service entrance equipment need not contain an equipment grounding conductor.
3. Metal conduit containing only a grounding conductor, and which is provided for mechanical protection of the conductor, shall be bonded to that conductor at the entrance and exit from the conduit.

G. Feeders and Branch Circuits: Install equipment grounding conductors with all feeders, power and lighting branch circuits.

H. Boxes, Cabinets, Enclosures, and Panelboards:
1. Bond the equipment grounding conductor to each pullbox, junction box, outlet box, device box, cabinets, and other enclosures through which the conductor passes.
2. Provide lugs in each box and enclosure for equipment grounding conductor termination.
3. Provide ground bars in panelboards, bolted to the housing, with sufficient lugs to terminate the equipment grounding conductors.

I. Motors and Starters: Provide lugs in motor terminal box and starter housing or motor control center compartment to terminate equipment grounding conductors.

J. Receptacles shall not be grounded through their mounting screws. Ground with a jumper from the receptacle green ground terminal to the device box ground screw and the branch circuit equipment grounding conductor.

K. Ground lighting fixtures to the equipment grounding conductor of the wiring system when the green ground is provided; otherwise, ground the fixtures through the conduit systems. Fixtures connected with flexible conduit shall have a green ground wire included with the power wires from the fixture through the flexible conduit to the first outlet box.

L. Fixed electrical appliances and equipment shall be provided with a ground lug for termination of the equipment grounding conductor.

3.4 CONDUCTIVE PIPING

A. Bond all conductive piping systems, interior and exterior, to the building to the grounding electrode system. Bonding connections shall be made as close as practical to the equipment ground bus.

3.5 TELECOMMUNICATIONS SYSTEM

A. Bond telecommunications system grounding equipment to the electrical grounding electrode system.

3.6 GROUND RESISTANCE

A. Grounding system resistance to ground shall not exceed 15 ohms. Make necessary modifications or additions to the grounding electrode system for compliance without additional cost to the Owner. Final tests shall assure that this requirement is met and test results shall be submitted to the Owner with final close out documents.

B. Resistance of the grounding electrode system shall be measured using a four-terminal fall-

of- potential method as defined in IEEE Standard 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

C. Below-grade connections shall be visually inspected by the IOR prior to backfilling. The Contractor shall notify the IOR 24 hours before the connections are ready for inspection.

D. Furnish a copy of tests to Owner at completion of project.

END OF SECTION 26 05 26

SECTION 26 05 33 RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Conduit and fittings.
2. Outlet boxes.
3. Weatherproof outlet boxes.
4. Junction and pull boxes.
5. Floor boxes.
6. Cabinets, termination cabinets.
7. Gutters.

B. Related Work:
1. Installation of all wire, cable, conductor, boxes/gutters, pull ropes, fiber optic cable raceway, conduit, innerduct, cable sleeve and duct as described on the plans and/or as specified here-in. This scope shall include pathways to be installed underground onsite and offsite, underslab, above grade, both concealed and exposed, overhead concealed and exposed as appropriately applied. Raceways/boxes shall be installed in accordance with their intended and allowed uses and as specified here-in whichever is more restrictive. Size and capacity of all raceway/boxes shall be as specified here-in or as depicted on the drawings, but shall not be less than that required by code. Larger raceway sizes may be specified than code would permit. The specifications shall govern.
2. Listed products for termination, coupling, extending, benching supports of raceways shall be used.
3. Raceways/boxes described by this section shall include, but not be limited to, power for site utilities and lighting, site and building communications, controls, fire alarm, data system, power distribution, lighting, lighting controls, video, intercom, and other building low voltage/communications systems controls as may be required.
4. Protection of and cleanliness of pathways and raceways must be assured during the construction process in order to eliminate the possibility of debris entering the conduit, duct, pathway resulting in decreased wire capacity and potential damage to installed conductors and cables.
5. Pathways are shown in a diagrammatic way and are generally accurate as to routing, however, it is the Contractor’s responsibility as a means and methods process to coordinate with all other trades that require space within a building. The Contractor shall obtain approval for installation of raceways routing through structural footings, retaining walls, columns, beams, purlins, grade beams, etc.
6. It is the Contractor’s responsibility to insure that all raceway and boxes systems penetrate fire assemblies and sound rated assemblies in an approved manner using the appropriate and listed products for the purpose.
7. Minimum conduit size shall be 3/4" except if plan shows or code requires larger size. Exception: Use minimum 1" for underslab and below grade applications outside of building exterior walls.
8. All electrical systems shall be installed in an approved conduit system. This shall include but not be limited to all systems described in Section B.3 above.
9. All line voltage wiring above-grade within the building shall be installed in metallic

conduit.

10. Empty or future conduits shall be properly plugged with plastic caps or inserts with a 3/8" polyethylene pull rope. Plastic or "duct" tape will not be acceptable.
11. All low voltage systems including data, voice, intercom, fire alarm, public address, etc. shall be in raceways separated from line voltage cabling. Voice / Data and Direct Digital Control (DDC) systems for HVAC cabling shall be routed as specified in Section 27 41 16 and 23 09 23 respectively, and as recommended by EIA/TIA standards. It shall be the contractor's responsibility to provide raceway down walls to outlet boxes and to provide sleeves across inaccessible ceiling spaces.
12. Underground conduits entering building shall have the open end of conduit within building above the elevation of the conduit outside the building such that water cannot enter building through conduit. If such a condition exists, a pull box outside of building footprint shall be installed in conduit route before conduit enters building whereby top of pull box is below finish floor of building and moisture may exit box before entering building.
13. No single conduit run of any type shall exceed 300 degrees of radius bend from termination box to termination box.
14. Separate Raceway System - Provide a separate raceway system for each of the following systems installed. Do not combine different systems into a raceway or cable tray system, unless otherwise noted or allowed. Mechanical controls and raceway shall be provided by others in separate raceway from the below systems:
    a. Fire Alarm.
    b. Line Voltage.
    c. All other low voltage systems provided by electrical contractor.
15. Spare, Future Conduits: Conduits labeled conduit only, spare, or for future use, shall be provided with a pullrope, capped at each end, labeled as spare with destination marked, and turned over to the Owner in an unused state. Contractor shall not utilize these conduits for the installation of cabling or conductors as part of this scope of work. Contractor to verify and install at no additional cost to the Owner, additional conduits as required for the installation of the systems being installed.
16. Outlet System: Provide electrical boxes and fittings as required for a complete installation. Including but not limited to outlet boxes, junction boxes, pull boxes, bushings, locknuts, covers and all other necessary components.
17. Code Compliance: Comply with CEC as applicable to construction and installation of electrical boxes and fittings and size boxes according to CEC 312, 314 and 366 except as noted otherwise.
18. Outlets to be flush mounted: Maintain integrity of insulation and vapor barrier. Unless otherwise noted, flush mount all outlet boxes.
19. Provide putty pads of proper type around outlet boxes and/or as detailed on plan to meet sound transmission restrictions and fire ratings of walls.

1.3 SUBMITTALS

A. Provide Product Data for the Following Equipment:
1. Conduit and fittings.
2. Outlet boxes.
3. Weatherproof outlet boxes.
4. Junction and pull boxes.
5. Floor boxes.
6. Cabinets, termination cabinets.
7. Gutters.
8. Putty pads.
9. Raceways

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Conform to requirements of the CEC, latest adopted version with amendments by local AHJs.
   2. Furnish products listed by UL or other independent and nationally recognized testing firm.

PART 2 PRODUCTS

2.1 MATERIALS

A. Heavy wall Rigid Non-Metallic Conduit, shall be PVC schedule 40 manufactured in accordance with NEMA Standard TC-2, UL-651 and WC 1094A specifications.

B. Extra heavy wall non-metallic conduit, shall be PVC schedule 80 manufactured in accordance with NEMA Standard TC-2, UL-651 and WC 1094A specifications.

C. Galvanized Rigid Steel (GRS) conduit shall be hot dipped galvanized, zinc coated and shall comply with Underwriters Laboratories UL-6, ANSI Specification C-80.1 and Federal Specification WW-C-581E.

D. Electrical Metallic Tubing (EMT) shall be zinc coated, with a protective coating applied to the inside surface and shall comply with Underwriter Laboratories UL-797 ANSI Specification C-80.3 and Federal Specification WW-C-563A.

E. Electrical Non-Metallic Tubing (ENT), shall be listed to requirements of U.L. 1653, in accordance with CEC Article 362, and meet requirements of BI National Standard CAN/CSA- C22.2 No. 227.1-U.L. 1653. ENT shall be rated for 90 degrees C conductors and shall be recognized for use in 2-hour fire resistance non-load bearing and load bearing wall assemblies. ENT shall be recognized for through-penetration firestop systems as classified to meet U.L. and ICC building codes. ENT shall only be allowed for data cabling systems and will not be permitted for Fire Alarm or line-voltage systems.

F. Flexible Metal Conduit (FMC) shall be continuous wound reduced wall galvanized steel produced to UL standards.

G. Liquid tight flexible metal conduit shall have a thermoplastic cover over a galvanized steel core containing an integral copper ground in sizes to 1 1/4" and shall be in compliance with UL standards and CEC Article 350.

H. Wire basket tray shall be 12” wide with 4” side rails minimum unless otherwise noted. It shall be U.L. listed and use listed connectors, elbows, tees, etc. and be cut and installed using listed equipment. Material shall be zinc electroplated steel.

I. Cable runway tray shall be 12” wide with 4” side rails minimum unless otherwise noted. It shall be U.L. listed and use listed connectors, elbows, tees, etc. Material shall be hollow steel with gray painted finish.

J. Manufacturers:
   1. Outlet Boxes: Bowers, Raco, Orbit, Steel City or equal.
   2. Weatherproof Outlet Boxes: Bell, Red Dot, Carlon or equal.
   3. Floor Boxes: Wiremold/Walker, Hubbell, Steel City, or equal.
   4. Junction and Pull Boxes: Circle AW, Hoffman, Wireguard or equal.
   5. Box Extension Adapter: Bell, Red Dot, Carlon or equal.
   6. Conduit Fittings: O-Z Gedney, Thomas & Betts, Raco, Crouse Hinds, or equal.
   7. Putty pads: 3M, Hilti, or equal.

8. Heavy wall rigid non-metallic conduit, Carlon, Certainteed, R&G Sloane or equal.
9. Extra heavy wall non-metallic conduit, Carlon, Certainteed, R&G Sloane or equal.
10. Galvanized Rigid Steel (GRS) conduit shall be hot dipped galvanized, zinc coated and shall comply with Underwriters Laboratories UL-6, ANSI Specification C-80.1 and Federal Specification WW-C-581E.
11. Electrical Metallic Tubing (EMT) shall be zinc coated, with a protective coating applied to the inside surface and shall comply with Underwriter Laboratories UL-797 ANSI Specification C-80.3 and Federal Specification WW-C-563A.
12. Electrical Non-Metallic Tubing (ENT), shall be listed to requirements of U.L. 1653, in accordance with CEC Article 362, and meet requirements of BI National Standard CAN/CSA-C22.2 No. 227.1-U.L. 1653. ENT shall be rated for 90 degrees C conductors and shall be recognized for use in 2-hour fire resistance non-load bearing and load bearing wall assemblies. ENT shall be recognized for through-penetration firestop systems as classified to meet U.L. and CBC building codes.
13. Flexible Metal Conduit (FMC), Alflex, American Flexible Conduit or equal.
14. Liquid tight flexible metal conduit, Anacanda (type UA), Electri-flex Liquatite or equal.
15. Floor Boxes, Single Gang, Walker/Wiremold 880 CS Series or approved equal.
16. Floor Boxes, Multiple Gang, Walker/Wiremold RFB Series or Walker Omnibox multi-service floor box with carpet plates, and/or water resistant device covers.
17. Masonry Boxes, outlets in concrete, Raco Series 690 or equal.
18. Wire basket tray, B-line, GS Metals, Cablofil, Chatsworth, FlexTray or equal.
19. Cable runway tray, B-line, CPI, Homaco, Chatsworth, FlexTray or equal.

2.2 OUTLET BOXES

A. NEMA 1 gutter, junction and pull boxes shall be fabricated from code gage steel finished in grey enamel with screw cover fronts and concentric knockouts in all sides.

B. NEMA 3R gutter, junction and pull boxes shall be fabricated from code gage galvanized steel with screw cover fronts and concentric knockouts in the bottom only. Any penetrations to the side, top or back shall be weatherproofed in an approved manner such as “MYERS” gasketed type hub or equal.

C. Steel outlet boxes and plaster rings shall be galvanized rigid assemblies, either one piece pressed or factory welded construction containing the size and number of knockouts required. Steel outlet boxes shall be manufactured, sized and installed in accordance with CEC Article 314. Device Outlet: Installation of one or two devices at common location, minimum 4” square, minimum 1 1/2" deep. Single or 2 gang flush device plaster ring. Raco or equal.

D. Luminaire Outlet: minimum 4” square with correct plaster ring depth, minimum 1 1/2” deep with 3/8” luminaire stud if required. Provide proper depth plaster ring on bracket outlets and on ceiling outlets.

E. Construction: Provide galvanized steel interior outlet wiring boxes, of the type, shape and size, including depth of box, to suit each respective location and installation; constructed with stamped knockouts in back and sides, and with threaded holes with screws for securing box covers or wiring devices. Boxes shall be properly secured to the structure such that they are flush with the finish surface. Boxes shall be made structurally secure by means of the proper fastening devices.

F. Accessories: Provide outlet box accessories as required for each installation, including mounting brackets, wallboard hangers, extension rings, plaster rings, luminaire studs, cable clamps and metal straps for supporting outlet boxes, compatible with outlet boxes being used and meeting requirements of individual wiring situations.

2.3 JUNCTION AND PULL BOXES

A. Construction: Provide galvanized sheet steel junction and pull boxes, with screw-on covers; of the type shape and size, to suit each respective location and installation; with welded seams and equipped with steel nuts, bolts, screws and washers.

B. Location:
1. Install junction boxes above accessible ceilings for drops into walls for receptacle outlets from overhead.
2. Install junction boxes and pull boxes as required to facilitate the installation of conductors and limiting the accumulated angular sum of bends between boxes, cabinets and appliances to 300 degrees.
3. Locations: Junction boxes shall be located only where necessary and only in equipment rooms, closets, and accessible attic and underfloor spaces. A horizontal distance of 24” shall separate outlet boxes on opposite sides of occupancy separation walls, fire-rated walls or partitions.
4. Labeling: Junction box covers shall be marked with indelible ink indicated the circuit numbers passing through the box.

2.4 CONDUIT FITTINGS

A. Requirements: Provide corrosion-resistant punched-steel box knockout closures, conduit locknuts and plastic conduit bushings of the type and size to suit each respective use and installation.

B. Steel boxes may allow for field knock-out modifications, but shall in all other ways conform to code requirements.

2.5 FLOOR BOXES - SINGLE GANG

A. Construction: Deep cast iron fully adjustable before and after concrete pour with all required components for complete activation. Verify required components for application of service fittings, covers, monuments, and the like, attached to floor boxes.

B. Activations:
1. Flush: Provide brass duplex or single signal cover, hinged with set screw lock. Carpet or tile finish ring.
2. Monuments: Provide stainless steel monuments with power receptacle or data grommet as noted.
3. Coordinate specific application of systems as noted on Drawings.

2.6 FLOOR BOXES - MULTIPLE GANG

A. Construction: Deep cast iron, fully adjustable before and after pour. Equal to Walker/Wiremold RFB Series or Walker Omnibox multi-service floor box with carpet plates, and/or water resistant device covers. Verify color. Partition for different power or signal applications. Provide required power receptacle devices and signal grommets or receptacles as noted. Flange types shall be compatible with floor covering for either carpet or vinyl as required and shall be brass type not polycarbonate.

B. Floor mounted boxes shall be water tight and cast iron when installed in grade level concrete slab floor, fully adjustable with interior and exterior leveling screws. Receptacle flange shall be brass with a duplex lift lid. Flange type shall be compatible with floor type. Before installation, coordinate exact location with Architect.

2.7 PUTTY PADS

A. Intumescent moldable firestop putty designed to protect electrical outlet boxes.

PART 3 EXECUTION

3.1 INSTALLATION

A. Conduit systems listed below are for use in installations where they are permitted to be used by CEC and/or other occupancy restrictions. The below installation methods do not intend to suggest that these materials be installed in conflict with any applicable code. Special attention to applications shall be made in building types such as wet location, hazardous locations, assembly occupancy and multi-story, but not limited to these. Requirements which are more restrictive than the CEC may be called for by the drawings and / or these specifications. These requirements must be adhered to. The Electrical Contractor shall be responsible to use the proper conduit system for the application. Exposed conduit is not allowed below ceilings or above slab of floor, without prior approval from Electrical Engineer. All conduits shall be concealed except in electrical and telecommunication rooms or where shown to be surface mounted. Exposed conduit (where allowed) shall be run square and plumb with building lines in an approved manner. Support roofmount conduits, where allowed, with minimum 12” wide approved rooftop supports (B-Line Durablok, or approved equal) unless otherwise detailed in roof requirements or as specified in roofing specification. Strap conduits to blocks with proper sized conduit straps. Spacing of support shall be a minimum as provided for in the CEC. All exposed conduit mounted below 8’ above finished grade shall be strapped at a minimum of 5’ spacing.

B. Electrical Non-Metallic Tubing (ENT) shall be installed in accordance with its listed application. Only listed cement shall be used for connectors, coupling, fittings requiring cement. Unless otherwise noted, ENT systems shall be color coded: Blue for branch and/or feeder power wiring, yellow for communications systems, and red for fire alarm and emergency power systems. Use only approved and listed accessories:
   1. Electrical Nonmetallic Tubing (ENT) is designed to replace EMT, flexible metal conduit or other raceway or cable systems, for installation in accordance with Article 362 of the National Electrical Code, Section 12-1500 of the CEC, other applicable sections of the Code, and local codes.
   2. Any ENT used shall be listed to the requirements of UL Standard UL 1653 in accordance with Article 362 of the NEC and Section 12-1500 of the CEC.
   3. Any ENT used shall meet the requirements of BI National Standard CAN/CSA-C22.2 No. 227.1-UL1653 and shall be Listed/Certified in accordance to the Electrical Codes.
   4. Carlon’s ENT shall be installed per the technical assessment prepared by fire cause analysis for use in 1hour and 2-hour rated construction.
   5. Penetration of fire rated walls, floors or ceilings shall use Classified Through-Penetration Firestop Systems described in the current Underwriters Laboratories Fire Resistance Directory.
   6. Fittings and outlet boxes shall be designed for use with ENT shall be listed. All fittings, boxes and accessories shall be from one manufacturer.
   7. Only Carlon ENT Blue cement recommended specifically for use with ENT and rigid nonmetallic fittings shall be used.
   8. Unless indicated differently on drawings, ENT systems shall be color coded: BLUE for branch and feeder circuit wiring, YELLOW for communications, and RED for fire alarm and emergency systems, or colors can designate different voltages.
   9. ENT, fittings, and accessories shall be manufactured by Carlon.
   10. ENT shall not be used or allowed in any application where not allowed by CEC Article 362.

C. Non-Metallic Rigid Conduit shall be used in concrete slabs, below concrete slabs on grade, or underground outside of a building slab or foundation. Maintain minimum depth requirements and cover with appropriate fill material. Conduit shall be heavy wall Schedule 40 or 80, rigid PVC only. Rigid utility P&C duct shall not be used in any application. Properly sized grounding conductors shall be installed per CEC article 250, in all non-metallic conduit branch circuit and feeder runs. PVC conduit shall be formed or field bent only with the use of properly approved bending tools such as to not decrease the internal bore of the conduit. All conduits shall be cut square and reamed of burrs. Approved and compatible glue shall be used on all PVC fittings to attain watertight joints.

D. Galvanized Rigid Steel (GRS) conduit shall be used where exposed less than 8'–0" above finished grade to 18" below finished grade and where subject to physical damage. Conduits shall be cut square and reamed to remove burrs and sharp edges. Strap conduit below 8' above grade at 5' intervals. Unless otherwise noted, threadless setscrew and threadless weathertight fittings may be used in lieu of threaded fittings. All threaded ends entering a junction box of any type shall require one locknut on the inside and one on the outside of the enclosure and be provided with a plastic bushing or grounding bushing where necessary for proper grounding. Where exposed to moisture, a watertight hub or other approved method shall be required. All conduits shall be stubbed up straight and uniform into junction boxes, panels, cabinets, etc., and shall be (GRS) properly supported and strapped. All GRS conduit located below grade, shall be tape wrapped.

E. Electrical Metallic Tubing (EMT) shall be used as allowed by code and as permitted by this specification. It shall not be in contact with soil or the concrete slab on the ground floor of any structure. Connectors and couplings shall be steel insulated set screw type where installed in indoor dry locations not subject to moisture. Where the potential for moisture is present, compression type weathertight fittings are required. One hole conduit straps are permitted from 1/2" to 1" and two hole conduit straps are required for size 1 1/4" and larger. EMT shall not be allowed in areas subject to severe physical damage. Install copper ground wire sized per CEC 250-122 in all EMT conduits.

F. Flexible conduit may be used where concealed in building construction or above dropped ceilings, but shall meet the following criteria: No individual circuit path from distribution panel to last device shall exceed a cumulative length of 6' of flexible conduit from start to end. Flexible conduit shall not exceed a total directional change of 270 bending degrees in any one run between conduit terminations. Squeeze type or Jake type steel flex fittings of a grounding type are required. Flexible conduit must be supported in accordance with CEC. Where exposed to the weather, moisture, or spray down flexible conduit shall be of the liquidtight type. Fittings shall be manufactured for use with liquidtight flexible conduit. All motor connections shall be made with liquidtight flex. Flexible conduit may not be used where exposed except for last 2' of equipment connection and unless otherwise noted or approved. A copper ground wire sized per CEC 250-122 shall be installed in all flexible conduit runs. Flexible conduit may not be used exposed. Weatherproof liquid tight conduit shall not be used at roof level for equipment connections with lengths exceeding 24" nor shall it be used to circumvent a rigid conduit systemin a horizontal direction. Connect recessed lighting fixtures to conduit runs with a maximum of 6' of flexible metal conduit extending from junction box to fixture.

G. Underground conduits and transition to above grade/slab shall be as follows:
   1. PVC elbows 2" and smaller are allowed, or if top of elbow is minimum 18" BFG or below top of slab, otherwise GRS elbows are required.
   2. GRS risers are required from elbow below grade to equipment (device, outlet, panel, cabinet, etc.) above grade.
   3. GRS elbows/risers to be PVC coated or 10 MIL tape wrapped (1/2" lapped) to 3" above finish grade or top of slab.

H. Conduit Supports: Conduit runs may be supported by one-hole and two-hole straps or supports as manufactured by Unistrut, Minerallac, Caddy or equals. Supports may be fastened by means of anchors, shields, beam clamps, toggle bolts, or other approved methods appropriate for the application and size of conduit. Pipe nailers (J-hooks) may only be used for 1" conduit and smaller and only in wood frame construction. Conduit support methods are subject to review by the engineer and authority having jurisdiction for adequacy. Installations deemed inadequate shall be corrected by the contractor at no cost to the Owner.

I. Bends and offsets shall be made with approved tools for the type of conduit being utilized. Bends shall be made without kinking or destroying the smooth bore of the conduit. Parallel conduits shall be run straight and true with bends uniform and symmetrical. Minimum radii shall be per CEC 344-24.

J. Conduit Stub-outs below grade shall be capped with plastic cap, and identified by placing a pull box marked with correctly identified utility such as "Elec", "Tel", etc. Dimension for exact location on field record drawings. Provide lids for proper field application (i.e. traffic, incidental, pedestrian).

K. Conduit Seals - Where below grade conduits enter structure through slab or retaining wall of building or basement, seal the inside of each conduit as follows:
1. Provide damming material around conductors 3" into conduit. Polywater or equal.
2. Fill 3" of conduit with 3M #2123 sealing compound.
3. Wrap conductors where they exit the conduit with 3M #2229 "Scotch Seal" mastic tape. Lap tape to approximate diameter of the raceway and wrap outside of conduit opening with (minimum) one turn.
4. Use conduit sealing bushings type CSB (O-Z/Gedney) or equal.
5. Empty conduits shall be sealed with standard non-hardening duct seal compound and then capped to prevent entrance of moisture and gases and to meet fire resistance requirements.
6. Provide cable drip loop minimum 12" high.

L. Marker tape: Place marker tape at 12" below finish grade along and above buried conduits. Label tape "CAUTION: ELECTRICAL LINES BELOW" or similar wording.

M. Electrical and communications systems raceways routed underground shall not occupy the same trench as plumbing utilities such as sewer, water, storm drain, gas or other wet or dry gaseous utility system. A minimum of 12" of undisturbed earth is required. Where utilities must cross in closer proximity to each other due to physical constraints, 6" minimum crossing distances are allowed.

N. Conduits, routed below footings, slabs, grade beams, columns, and other structural elements shall be installed in strict compliance with structural details and criteria shown on structural plans. Clearances below structural elements and sleeves through structural elements must be carefully planned to avoid conflict and must be approved by the structural engineer if conflict arises.

O. All conduit or raceways passing through fire rated walls, floors, or ceilings shall be installed with a listed penetration method which protects the opening to the same rating as the assembly and is non hardening.

P. Cable runway shall be used in equipment rooms where shown on the plans. Ladder tray installations shall conform to the requirements of CEC Article 318. The contractor shall provide all mounting hardware, connectors and bracing as required and as recommended by the manufacturer for a complete system installation.

Q. Wire basket tray shall be used in all concealed spaces (above ceiling spaces, under buildings in access tunnels, below raised floors, etc.) unless otherwise noted. Wire basket tray installations shall conform to the requirements of CEC Article 318. The contractor shall provide all mounting hardware, connectors and bracing as required and as recommended by the manufacturer for a complete system installation. All cutting and bending of wire basket tray shall be per the manufacturer's recommendation using tools designed for that purpose. Cable loading shall not exceed the listing of the system and its support.

R. Location: Locate boxes and conduit bodies so as to ensure accessibility of electrical wiring.

S. Anchoring: Secure boxes rigidly to the substrate upon which they are being mounted, or solidly embed boxes in concrete or masonry.

T. Special Application: Provide weatherproof outlets for locations exposed to weather or moisture.

U. Knockout Closures: Provide knockout closures to cap unused knockout holes where blanks have been removed.

V. Mount outlet boxes, unless otherwise required by ADA, or noted on drawings, the following distances above the finished floor:
1. Receptacles, Telephone, TV & Data outlets. (measured to bottom of outlet box): +15".
2. Outlet above counter (measured to top of outlet box): +46".
3. Control (light) Switches. (measured to top of outlet box): +48".
4. Fire Alarm Manual Pull Stations, T-stats. (measured to top of outlet box): +48".
5. Fire Alarm Visuals: the lower of +80" to bottom of lens, or 6" below ceiling.
6. Other Outlets: As indicated in other sections of specifications or as detailed on drawings.

W. Coordinate all electrical device locations with the architectural floor plan and interior and exterior elevations to prevent mounting devices within elements that they may conflict such as cabinetry, mirrors, planters, etc.

X. Size outlet and junction boxes to minimum wire fill space requirements. Upsize box as required to allow ease of wire installation and device installation.

Y. Outlet and junction boxes in fire rated walls shall be gauged and spaced so as not to exceed the maximum penetration allowed by the assembly without compromising the fire rating. If a conflict arises relative to a specific condition, the contractor shall follow the requirements of the fire authority and ask for guidance from the design team. At no time should a larger box be installed prior to resolution of conflict.

END OF SECTION 26 05 33

SECTION 26 05 43 – UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Ducts in concrete-encased duct banks.
2. Handholds and handhole accessories.
3. Manholes and manhole accessories.

1.2 SYSTEM DESCRIPTION

A. Interconnected system of encased conduits, ducts, manholes and handholes to distribute power and telecommunications.

B. Conduit and duct routing, manhole, and handhole locations are shown in approximate locations unless dimensions are indicated. Route and locate to complete duct bank system.

C. Use concrete encased rigid steel or concrete encased rigid plastic conduits for all underground ducts.

1.3 SUBMITTALS

A. Product Data: For the following:

1. Manholes.
2. Handholes.
3. Hardware.
4. Conduit and ducts, including elbows, bell ends, bends, fittings, and solvent cement.
5. Duct-bank materials, including spacers and miscellaneous components.
6. Warning tape. Detectable type.

B. Shop Drawings: Show fabrication and installation details for underground ducts and utility structures and include the following:

1. For manholes:

a. Duct sizes and locations of duct entries.
b. Reinforcement details.
c. Manholes cover design and engraving.
d. Step details.
e. Grounding details.
f. Dimensioned locations of cable rack inserts, pulling-in irons, and sumps.

C. Coordination Detailing Activity Drawings: Show duct profiles and coordination with other utilities and underground structures. Include plans and sections drawn to scale, and show all bends and location of expansion fittings.

D. Product Certificates: For concrete and steel used in underground precast manholes, according to ASTM C 858.

E. Product Test Reports: Indicate compliance of manholes with ASTM C857 and ASTM C858, based on factory inspection.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual routing and elevations of underground conduit and duct, and locations and sizes of manholes and handholes. Provide dimensions off of fixed elements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver ducts to Project site with ends capped. Store nonmetallic ducts with supports to prevent bending, warping, and deforming.

B. Store precast concrete units at Project site as recommended by manufacturer to prevent physical damage.

C. Arrange so identification markings are visible.

D. Lift and support precast concrete units only at designated lifting or supporting points.

1.6 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving occupied facilities unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated.

1. Comply with Owner's power shut-down procedures.

2. Do not proceed with utility interruptions without Owner's Representative written permission.

1.7 COORDINATION

A. Coordinate layout and installation of ducts, manholes, and handholes with final arrangement of other utilities and site grading, as determined in the field.

B. Coordinate elevations of ducts and duct-bank entrances into manholes and handholes with final profiles of conduits as determined by coordination with other utilities and underground obstructions. Revise locations and elevations from those indicated as required to suit field conditions and to ensure duct runs drain to manholes and handholes, and as approved by an Owner Representative.

PART 2 - PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS

A. Manufacturers:

1. Underground Precast Concrete Utility Structures:

a. Jensen Precast.
b. Utility Vault Co.
c. Brooks

2. Frames and Covers:

a. Alhambra Foundry
b. Campbell Foundry Co.
c. East Jordan Iron Works, Inc.

2.2 DUCTS

A. Rigid Nonmetallic Conduit: NEMA TC 2, Type EPC-40-PVC, UL 651, with matching fittings by the same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

2.3 HAND HOLES

A. Cast-Metal Boxes: Cast aluminum, with outside flanges and recessed, gasketed cover

for flush mounting and with nonskid finish and legend on cover. Unit, when buried, shall be designed to support AASHTO H10 loading for sidewalk and landscaped areas and HS20 for roadways, parking lots and loading docks.

B. Precast Handholes: Reinforced concrete, monolithically poured walls and bottom, with steel frame and access door assembly as the top of handhole. Duct entrances and windows shall be located near corners to facilitate racking. Pulling-in irons and other built-in items shall be installed before pouring concrete. Cover shall have nonskid finish and legend. Unit, when buried, shall be designed to support AASHTO H10 loading for sidewalk and landscaped areas and HS20 for roadways, parking lots and loading docks. Cover Legend: All underground pull box covers shall have the following cast-in or bead welded and galvanized identification label permanently affixed to the exterior:

1. “ELEC-LV” for electrical power circuits 600 volts or less.
2. “ELEC-HV” for electrical power circuits over circuits over 600 volts.
3. “COMM” for communications circuits.

2.4 PRECAST MANHOLES

A. Precast Units: Interlocking mating sections, complete with accessories, hardware, and features as indicated. Include concrete knockout panels for conduit entrance and sleeve for ground rod.

B. Entry way diameter: 36 inches minimum.

C. Design and fabricate structure according to ASTM C858.

D. Structural Design Loading: ASTM C857, Class A-16 (AASHTO HS20).

E. Base section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.

F. Riser Sections: 4-inch minimum thickness, and lengths to provide required depth.

G. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.

H. Steps: ASTM A615, deformed, 1/2-inch steel reinforcing rods encased in ASTM D4101, PP, wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 36 inches. Adjust to custom manhole locations.

I. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover.

J. Joint Sealant: ASTM C990, bitumen or butyl rubber.

K. Protective Coating: Plant-applied, coal-tar, epoxy-polyamide paint 15-mil minimum thickness applied to exterior and interior surfaces.

L. Source Quality Control: Inspect structures according to ASTM C1037.

M. Access Ladder: Provide permanent metal access ladder.

2.5 ACCESSORIES

A. Duct Spacers: Rigid PVC interlocking spacers, selected to provide minimum duct spacings and cover depths indicated while supporting ducts during concreting and backfilling; produced by the same manufacturer as the ducts.

B. Manhole Frames and Covers: Comply with AASHTO loading specified for manhole; Ferrous frame 36 inch clear ID by 6 inch minimum riser with 4-inch-minimum width flange

and 38-inch-diameter cover.

1. All manhole and underground pullbox covers shall have the following cast-in or bead welded and galvanized identification label permanently affixed to the exterior:
   a. “ELEC-LV” for electrical power circuits 600 volts or less.
   b. “ELEC-HV” for electrical power circuits over circuits over 600 volts.
   c. “COMM” for communications circuits.
2. Cast iron with cast-in legend as indicated above subsection 1: Milled cover-to-frame bearing surfaces.
3. Manhole Frames and Covers: ASTM A48; Class 30B gray iron, 36-inch size, machine- finished with flat bearing surfaces.

C. Sump Frame and Grate: ASTM A48, Class 30B gray cast iron.

D. Pulling Eyes in Walls: Eyebolt with reinforcing-bar fastening insert 2-inch- diameter eye and 1-by-4¬inch bolt.
   1. Working Load Embedded in 6-Inch, 4000-psi Concrete: 13,000-lbf minimum tension.

E. Pulling and Lifting Irons in Floor: 7/8-inch- diameter, hot-dip-galvanized, bent steel rod; stress relieved after forming; and fastened to reinforced rod. Exposed triangular opening.
   1. Ultimate Yield Strength: 40,000-lbf shear and 60,000-lbf tension.

F. Bolting Inserts for Cable Stanchions: Flared, threaded inserts of noncorrosive, chemical-resistant, nonconductive thermoplastic material; 1/2-inch ID by 2-3/4 inches deep, flared to 1- 1/4 inches minimum at base.
   1. Tested Ultimate Pullout Strength: 12,000 lbf minimum.

G. Expansion Anchors for Installation after Concrete Is Cast: Zinc-plated, carbon-steel-wedge type with stainless-steel expander clip with 1/2-inch bolt, 5300-lbf rated pullout strength, and minimum 6800-lbf rated shear strength.

H. Cable Stanchions: Hot-rolled, hot-dip-galvanized, T-section steel; 2-1/4-inch size; punched with 14 holes on 1-1/2-inch centers for cable-arm attachment.

I. Cable Arms: 3/16-inch- thick, hot-rolled, hot-dip-galvanized, steel sheet pressed to channel shape; 12 inches wide by 14 inches long and arranged for secure mounting in horizontal position at any location on cable stanchions.

J. Cable-Support Insulators: High-glaze, wet-process porcelain arranged for mounting on cable arms.

K. Duct-Sealing Compound: Non-hardening, safe for contact with human skin, not deleterious to cable insulation, and workable at temperatures as low as 35 deg F. Capable of withstanding temperature of 300 deg F without slump and of adhering to clean surfaces of plastic ducts, metallic conduits, conduit coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals.

L. Warning Tape: Provide underground-line detectable warning tape specified under section "Identification for Electrical Systems."

2.6 CONSTRUCTION MATERIALS

A. Seal manhole section joints with sealing compound recommended by the manhole manufacturer.

B. Damp proofing: Comply with "Bituminous Damp proofing."

C. Mortar: Comply with ASTM C270, Type M, except for quantities less than 2.0 cu. ft. where packaged mix complying with ASTM C387, Type M, may be used.

D. Brick for Manhole Chimney: Sewer and manhole brick, ASTM C32, Grade MS.

E. Concrete: Use 3000-psi- minimum, 28-day compressive strength and 1-inch maximum aggregate size.

F. Provide red dye added to concrete during batching.

PART 3 - EXECUTION

3.1 APPLICATION

A. Underground Ducts for Electrical Cables Higher than 600V: Type EPC-40-PVC, concrete- encased duct bank.

B. Manholes: Underground precast concrete utility structures.

C. Manholes: Cast-in-place concrete.

3.2 EARTHWORK

A. Restore surface features at areas disturbed by excavation and reestablish original grades, unless otherwise indicated. Soil compaction at all locations shall be as specified by civil and structural specifications.

B. Restore all areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary top soiling, fertilizing, liming, seeding, sodding, sprigging, and mulching.

C. Restore disturbed pavement.

3.3 CONDUIT AND DUCT INSTALLATION

A. Exercise care in excavating, trenching, and working near existing utilities. Locate any existing buried utilities before excavating.

B. Duct bank trench shall be shored, framed and braced for installing ducts. Frames, forms, and braces shall be either wood or steel. Variations in outside dimensions of the installed duct bank shall not exceed 2 inches on the vertical or the horizontal from the design. Remove forms and bracing after 24 hours and before backfilling.

C. Slope: Pitch ducts a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope ducts from a high point in runs between two manholes to drain in both directions. Duct banks shall be laid to a minimum grade slope of 4 inches per 100 feet. This slope may be from one manhole to the next or both ways from a high point between manholes, depending upon the contour of the finished grade.

D. Duct banks shall be installed so that the top of the concrete encasement shall be no less than 36 inches below grade or pavement for primary power. As a general rule, depths shall be a minimum of three feet, but not more than six feet.

E. Curves and Bends: Use manufactured 48 inches minimum elbows for stub-ups at equipment, and enclosures, and at building entrances. Use manufactured long sweep bends with a minimum radius of 4 feet minimum, both horizontally and vertically, at other locations. Manufactured long radius bends may be used in runs of 100 feet or less on approval from the Owner’s representative. Vertical feeder sweep into buildings shall be coated steel. Multiple conduit sweeps shall be concentric and maintain spacing throughout. Medium-voltage conduit sweeps shall be 12’ minimum radius sweeps.

F. Use solvent-cement joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in the same plane.

G. Duct Entrances to Manholes and Handholes: Space end bells approximately 10 inches

o.c. for 5-inch ducts and vary proportionately for other duct sizes. Change from regular spacing to end-bell spacing 10 feet from the end bell without reducing duct line slope and without forming a trap in the line. Grout end bells into manhole walls from both sides to provide watertight entrances. Where connection to bulkhead of duct bank is made to vaults or existing duct banks, the concrete encasement shall be doweled with on No. 4 reinforcement rod 36 inches long per conduit to the existing encasement.

H. Building Entrances: Make a transition from underground duct to rigid steel conduit 5 feet outside the building wall. Use fittings manufactured for this purpose. Follow the appropriate installation instructions below:

1. Concrete-Encased Ducts: Install reinforcement in duct banks passing through disturbed earth near buildings and other excavations. Coordinate duct bank with structural design to support duct bank at wall without reducing structural or watertight integrity of building wall. Expand duct bank at building entry to provide 6” spacing between sealing system sleeves. Coordinate sleeve placement with structural reinforcement bar placement.

2. Provide methane penetration EYS sealing fitting at each conduit penetration into building – both vertical and horizontal. Arrange so that sealant parts remain accessible.

3. Waterproofed Wall and Floor Penetrations: Install a watertight entrance-sealing device with sealing gland assembly on the inside. Anchor device into masonry construction

   with one or more integral flanges. Secure membrane waterproofing to the device to make permanently watertight. Seals shall be Link Seal Assembly with precast ‘CS” model – non-metallic sleeve by Link Seal or equal.

I. Concrete-Encased, Nonmetallic Ducts: Support ducts on duct spacers, spaced as recommended by manufacturer and coordinated with duct size, duct spacing, and outdoor temperature. Install as follows:

1. Separator Installation: Space separators 6’-0” O.C. to prevent sagging and deforming of ducts and secure separators to earth and to ducts to prevent floating during concreting. Stagger spacers approximately 6 inches between tiers. 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.

2. Duct joints in concrete may be placed side by side horizontally, but shall be staggered at least 6 inches vertically. Joints shall be made in accordance with manufacturer’s recommendations for the particular type of duct and coupling selected. In the absence of specific recommendations, plastic duct connections shall be made by brushing a plastic solvent cement on the inside of a plastic coupling fitting and on the outside of duct’s ends. The duct and fitting shall then be slipped together with a quick one- quarter turn to set the joint.

3. Concreting: Spade concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Use a plank to direct concrete down sides of bank assembly to trench bottom. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application. Pour each run of envelope between manholes or other terminations in one continuous operation. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch reinforcing rod dowels extending 18 inches into concrete on both sides of joint near corners of envelope. At connection to manholes, dowel concrete encasement with on No. 4 reinforcing bar 36 inches long per duct.

4. Reinforcement: Reinforce duct banks where they cross disturbed earth and

where indicated.

5. 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.

6. Minimum Clearances between Ducts: 3 inches between ducts and exterior envelope wall, 2 inches between ducts for like services, and 4 inches between power and signal ducts.

7. Depth: Install top of duct bank at least 24 inches below finished grade in no traffic areas and at least 30 inches below finished grade in vehicular traffic areas, unless otherwise indicated.

J. Direct-Buried Ducts: Direct-Buried Ducts are for temporary construction only and only as determined and approved by the Owner. Support ducts on duct spacers, spaced as recommended by manufacturer and coordinated with duct size, duct spacing, and outdoor temperature. Install as follows:

1. Separator Installation: Space separators not more than 4 feet center-to-center along entire length of duct bank including top pipes.

2. Install expansion fittings as required.

3. Trench Bottom: Continuous, firm, and uniform support for duct bank. Prepare trench bottoms for pipes less than 6 inches in nominal diameter.

4. Backfill: Install backfill. After installing first tier of ducts, backfill and compact. Repeat backfilling after placing each tier. After placing last tier, hand-place backfill to 4 inches over ducts and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, complete backfilling normally. Do not place backfill for a period of at least 24 hours after pouring of concrete.

5. Minimum Clearances between Ducts: 3 inches between ducts for like services and 6 inches between power and signal ducts.

6. Depth: Install top of duct bank at least 36 inches below finished grade, unless otherwise indicated.

K. Warning Tape: Bury metal backed detectable warning tape approximately 12 inches above all concrete-encased duct banks. Align tape parallel to and within 3 inches of the centerline of duct bank.

L. Stub-ups: Use rigid steel conduit for stub-ups to equipment. For equipment mounted on outdoor concrete bases, extend steel conduit a minimum of 5 feet from edge of base. Install insulated grounding bushings on terminations. Couple steel conduits to ducts with adapters designed for this purpose and encase coupling with 3 inches of concrete. Galvanized steel conduits installed below grade shall be painted with two coats of Koppers Bitumastic paint before installing in ground.

M. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.

N. Pulling Cord: Install 100-lbf- test nylon cord in all ducts, including spares. Identify opposite terminal points of duct.

O. Ductbanks shall be designed with 25% spare raceways for future use. In ductbanks with three (3) or less, provide one (1) spare conduit minimum.

3.4 MANHOLE AND HANDHOLE INSTALLATION

A. Elevation: Install manholes with rooftop at least 15 inches below finished grade. Install handholes with depth as required. Place and align precast manholes to provide horizontal tolerance of 2 inches in any direction and vertical alignment with not greater than 1/8 inch maximum tolerance for 6 foot of depth. Completed manhole shall be rigid, true to dimensions and alignment, and shall be watertight.

B. Drainage: Install drains in bottom of units where indicated. Coordinate with drainage provisions indicated. Sumps shall be knocked out at time of installation.

C. Access: Install cast-iron frame and cover.

1. Install precast collars and rings to support frame and cover and to connect cover with roof opening. Provide moisture-tight masonry joints and waterproof grouting for cast- iron frame to chimney.

2. Set frames in paved areas and traffic ways flush with finished grade. Set other frames 1 inch above finished grade.

D. Waterproofing: Apply waterproofing to exterior surfaces of units after concrete has cured at least three days. After ducts have been connected and grouted, and before backfilling, waterproof joints and connections and touch up abrasions and scars. Waterproof exterior of manhole and hand hole chimneys after brick mortar has cured at least three days. Seal manhole section joints with sealing compound recommended by the manhole manufacturer. Penetration into manholes and/or boxes shall be sealed. Provide conduit duct plugs for unused terminator openings of spare conduits in manhole. Do not water seal top removable cover until cable pulling has been completed.

E. Damp proofing: Apply damp proofing to exterior surfaces of units after concrete has cured at least three days. After ducts have been connected and grouted, and before backfilling, damp proof joints and connections and touch up abrasions and scars. Damp proof exterior of manhole and hand hole chimneys after brick mortar has cured at least three days.

F. Hardware: 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.

G. Field-Installed Bolting Anchors: Do not drill deeper than 3-7/8 inches for anchor bolts installed in the field. Use a minimum of two anchors for each cable stanchion.

H. Grounding: Install ground rod through floor in each structure with top protruding 6 inches above floor.

1. Seal floor opening against water penetration with waterproof nonshrink grout. Ground exposed metal components and hardware with bare-copper ground conductors. Train conductors neatly around corners. Use cable clamps secured with expansion anchors to attach ground conductors.

I. Precast Concrete Manhole Installation: comply with ASTM C 891.

1. Install units level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances.

2. Unless otherwise indicated, support units on a 12” level bed of crushed stone or gravel, graded from 1-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth. Provide a minimum 6-inch level base of ¾ inch crushed rock under manhole to ensure uniform distribution of soil pressure on floor.

3. Manholes below building floor shall have all earth work compacted to match compaction required by structural specifications.

3.5 FIELD QUALITY CONTROL

A. Testing: Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.

B. Grounding: Test manhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance.

C. Duct Integrity: Pull aluminum or wood test mandrel through duct to prove joint integrity and test for out-of-round duct. Provide mandrel equal to 80 percent fill of the duct. If obstructions are indicated, remove obstructions and retest.

D. Correct installations if possible and retest to demonstrate compliance. Remove and replace defective products and retest.

END OF SECTION 26 05 43

SECTION 26 05 53 IDENTIFICATION OF ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section Includes:
   1. Nameplates and warning signs where specified herein and as shown on contract documents including the following:
      a. Nameplates and warning signs permanently installed on all electrical equipment and devices including, but not limited to, the following items:
         1) Enclosures for transformers, switchboards, motor control, panels, pullboxes, cabinets, motors, generators, transfer switches.
         2) Enclosures for all separately enclosed devices including, but not limited to, disconnect switches, circuit breakers, contactors, time switches, control stations and relays, fire alarm panels and lighting control panel.
         3) Wall switches not within sight of outlet controlled.
         4) Special systems such as, but not limited to, telephone, fire alarm, warning and signal systems. Identification shall be at each equipment rack, terminal cabinet, control panel, annunciator and pullbox.
         5) Devices mounted within and part of equipment including circuit breakers, switches, control devices, control transformers, relays, indication devices and instruments.
   2. Conductor and Cable Identification.

B. Related Sections:
   1. Section 26 05 00: Common Work Results For Electrical.
   2. Section 26 05 19: Low-Voltage Electrical Power Conductors and Cables.

PART 2 PRODUCTS

2.1 EQUIPMENT LABEL DESIGNATIONS

A. Equipment labels indicating equipment designations both emergency and normal. Designation data per drawings or to be supplied with shop drawings approval.

B. Panelboard labels showing panel designation, voltage, phase and source.

C. Distribution panels, transformers, safety switches, transfer equipment, etc. Labels shall be per ANSI Z535.4 guidelines.

2.2 MATERIALS

A. For Labels: Three layer laminated plastic or micarta with engraved white letters over black background.

B. For Emergency Equipment: Use engraved white letters over red background.

C. For Warning Signs: Minimum 18 gauge steel with red lettering on white porcelain enamel

finish.

D. Arc flash labels shall be provided as required by CEC Article 70E.

E. Conductor tape number markers: TayMac MX4280 Series non-fading permanent adhesive.

2.3 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to the following:
1. Panduit Corp.
2. American Labelmark Co.
3. Markal Corp.
4. Calpico, Inc.
5. Ideal Industries, Inc.

PART 3 EXECUTION

3.1 MOUNTING

A. Equipment labels shall be mounted by self-tapping, threaded screws and bolts, or by rivets. Adhesive types are not acceptable unless specifically noted in this section.

B. Conductor tape markers shall be consistently placed for ready conductor identification.

3.2 HEIGHTS ON LABELS

A. Panelboards, Switchboards and Motor Control Centers and Special Systems Enclosures: 1/4" identify equipment designation; 1/8” identify voltage rating and source.

B. Individual Circuit Breakers, Switches, and Motor Starters in Panelboards, Switchboards, and Motor Control Centers: 3/16” identify circuit and load served, including location of equipment.

C. Enclosed Circuit Breakers, Enclosed Switches, and Motor Starters: 3/16” identify load served.

D. Transformers: 3/16” identify equipment designation; 1/8” identify primary and secondary voltages, primary source and secondary load. Include location of primary source or secondary load if remote from transformer.

3.3 WARNING SIGNS

A. Warning signs shall be permanently mounted with cadmium plated steel screws or nickel-plated brass bolts.

B. Warning signs to read "DANGER - HIGH VOLTAGE", with letters 1 1/2" high, 3/16” stroke minimum.

C. Provide warning sign on all doors or immediately next to door for equipment rooms, enclosures or closets containing equipment energized above 150 volts to ground as per CEC, and/or as directed by the Architect. For interior finish spaces and interior doors, signage shall be coordinated and approved with the Architect in advance of installation.

D. Underground Warning Tape. Description: four (4) inch wide plastic tape, colored red with suitable warning legend describing buried electrical lines.

3.4 UNDERGROUND WARNING TAPE INSTALLATIONS:

A. Install underground warning tape along length of each underground conduit, raceway, or cable six (6) to eight (8) inches below finished grade, directly above buried conduit, raceway, or cable. Where multiple lines installed in a common trench or concrete envelope, do not exceed an overall width of 16 inches; install a single line marker.

B. Install line marker for underground wiring, both direct buried and in raceway

3.5 PRINTED PANELBOARD DIRECTORY

1. Provide framed, typed circuit schedules with explicit description and identification of items controlled by each individual breaker for that panel, switchboard, or motor control center.
2. Panelboard directory shall include a legend indicating insulation color corresponding each phase and voltage in the building electrical system.
3. Copy in Owner's Manual.

3.6 ABOVE CEILING JUNCTION BOXES

A. Labeling: Provide label on all above ceiling junction boxes.
1. Provide permanent labeling with indelible black marker, in neat, legible print indicating the panelboard name, branch circuit number(s) and voltage of conductors within the junction box.

END OF SECTION 26 05 53

SECTION 26 05 70

SEISMIC CONTROLS FOR ELECTRICAL WORK

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 0 & 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes seismic restraints and other earthquake-damage-reduction measures for electrical components. It complements optional seismic construction requirements in the various electrical component Sections.

1.03 DEFINITIONS

A. CBC: California Building Code.

B. Seismic Restraint: A fixed device (a seismic brace, an anchor bolt or stud, or a fastening assembly) used to prevent vertical or horizontal movement, or both vertical and horizontal movement, of an electrical system component during an earthquake.

C. Mobile Structural Element: A part of the building structure such as a slab, floor structure, roof structure, or wall that may move independent of other mobile structural elements during an earthquake.

1.04 SUBMITTALS

A. Product Data: Illustrate and indicate types, styles, materials, strength, fastening provisions, and finish for each type and size of seismic restraint component used.
   1. Anchor Bolts and Studs: Tabulate types and sizes, complete with report numbers and rated strength in tension and shear as evaluated by ICC Evaluation Service.

B. Shop Drawings: For anchorage and bracing not defined by details and charts on Drawings. Indicate materials, and show designs and calculations signed and sealed by a professional engineer.
   1. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.

C. Coordination Drawings: Plans and sections drawn to scale and coordinating seismic bracing for electrical components with other systems and equipment, including other seismic restraints, in the vicinity.

D. Product Certificates: Signed by manufacturers of seismic restraints certifying that products furnished comply with requirements.

E. Qualification Data: For firms and persons specified in "Quality Assurance" Article.

F. Material Test Reports: From a qualified testing agency indicating and interpreting test results of seismic control devices for compliance with requirements indicated.

1.05 QUALITY ASSURANCE

A. Comply with seismic restraint requirements in California Building Code, unless requirements in this Section are more stringent.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing seismic engineering services, including the design of seismic restraints, that are similar to those indicated for this Project.

C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, with the experience and capability to conduct the testing indicated.

1.06 PROJECT CONDITIONS

A. Project Seismic Zone and Zone Factor as Defined in CBC: Zone 4, Zone Factor 0.40.

1.07 COORDINATION

A. Coordinate layout and installation of seismic bracing with building structural system and architectural features, and with mechanical, fire-protection, electrical, and other building features in the vicinity.

B. Coordinate concrete bases with building structural system.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Amber/Booth Company, Inc.
2. B-Line Systems, Inc.
3. Erico, Inc.
4. GS Metals Corp.
5. Loos & Company, Inc.
6. Mason Industries, Inc,
7. Powerstrut.
8. Thomas & Betts Corp.
9. Unistrut Corporation.

2.02 MATERIALS

A. Use the following materials for restraints:
1. Indoor Dry Locations: Steel, zinc plated.
2. Outdoors and Damp Locations: Galvanized steel.
3. Corrosive Locations: Stainless steel.

2.03 ANCHORAGE AND STRUCTURAL ATTACHMENT COMPONENTS

A. Strength: Defined in reports by ICC Evaluation Service or another agency acceptable to authorities having jurisdiction.
1. Structural Safety Factor: Strength in tension and shear of components used shall be at least two times the maximum seismic forces to which they will be subjected.

B. Concrete and Masonry Anchor Bolts and Studs: Steel-expansion wedge type.

C. Concrete Inserts: Steel-channel type.

D. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.

E. Welding Lugs: Comply with MSS SP-69, Type 57.

F. Beam Clamps for Steel Beams and Joists: Double sided. Single-sided type is not acceptable.

G. Bushings for Floor-Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings, and matched to the type and size of anchor bolts and studs used.

H. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to the type and size of attachment devices used.

2.04 SEISMIC BRACING COMPONENTS

A. Slotted Steel Channel: 1-5/8-by-1-5/8-inch cross section, formed from 0.1046-inch- thick steel, with 9/16-by-7/8-inch slots at a maximum of 2 inches o.c. in webs, and flange edges turned toward web.
   1. Materials for Channel: ASTM A 570, GR 33.
   2. Materials for Fittings and Accessories: ASTM A 575, ASTM A 576, or ASTM A 36.
   3. Fittings and Accessories: Products of the same manufacturer as channels and designed for use with that product.
   4. Finish: Baked, rust-inhibiting, acrylic-enamel paint applied after cleaning and phosphate treatment, unless otherwise indicated.

B. Channel-Type Bracing Assemblies: Slotted steel channel, with adjustable hinged steel brackets and bolts.

C. Cable-Type Bracing Assemblies: Zinc-coated, high-strength steel wire rope cable attached to steel thimbles, brackets, and bolts designed for cable service.
   1. Arrange units for attachment to the braced component at one end and to the structure at the other end.
   2. Wire Rope Cable: Comply with ASTM 603. Use 49- or 133-strand cable with a minimum strength of 2 times the calculated maximum seismic force to be resisted.

D. Hanger Rod Stiffeners: Slotted steel channels with internally bolted connections to hanger rod.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install seismic restraints according to applicable codes and regulations and as approved by authorities having jurisdiction, unless more stringent requirements are indicated.

3.02 STRUCTURAL ATTACHMENTS

A. Use bolted connections with steel brackets, slotted channel, and slotted-channel fittings to spread structural loads and reduce stresses.

B. Attachments to New Concrete: Bolt to channel-type concrete inserts or use expansion anchors.

C. Attachments to Existing Concrete: Use expansion anchors.

D. Holes for Expansion Anchors in Concrete: Drill at locations and to depths that avoid reinforcing bars.

E. Attachments to Solid Concrete Masonry Unit Walls: Use expansion anchors.

F. Attachments to Hollow Walls: Bolt to slotted steel channels fastened to wall with expansion anchors.

G. Attachments to Wood Structural Members: Install bolts through members.

H. Attachments to Steel: Bolt to clamps on flanges of beams or on upper truss chords of bar joists.

3.03 ELECTRICAL EQUIPMENT ANCHORAGE

A. Anchor rigidly to a single mobile structural element or to a concrete base that is structurally tied to a single mobile structural element.

B. Anchor panelboards, motor-control centers, motor controls, switchboards, switchgear, transformers, unit substations, fused power-circuit devices, transfer switches, busways, battery racks, static uninterruptible power units, power conditioners, capacitor units, communication system components, and electronic signal processing, control, and distribution units as follows:
   1. Size concrete bases so expansion anchors will be a minimum of 10 bolt diameters from the edge of the concrete base.
   2. Concrete Bases for Floor-Mounted Equipment: Use female expansion anchors and install studs and nuts after equipment is positioned.
   3. Bushings for Floor-Mounted Equipment Anchors: Install to allow for resilient media between anchor bolt or stud and mounting hole in concrete.
   4. Anchor Bolt Bushing Assemblies for Wall-Mounted Equipment: Install to allow for resilient media where equipment or equipment-mounting channels are attached to wall.
   5. Torque bolts and nuts on studs to values recommended by equipment manufacturer.

3.04 SEISMIC BRACING INSTALLATION

A. Install bracing according to spacings and strengths indicated by approved analysis.

B. Expansion and Contraction: Install to allow for thermal movement of braced components.

C. Cable Braces: Install with maximum cable slack recommended by manufacturer.

D. Attachment to Structure: If specific attachment is not indicated, anchor bracing to the structure at flanges of beams, upper truss chords of bar joists, or at concrete members.

3.05 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Make flexible connections in raceways, cables, wireways, cable trays, and busways where they cross expansion and seismic control joints, where adjacent sections or branches are supported by different structural elements, and where they terminate at electrical equipment anchored to a different mobile structural element from the one supporting them.

3.06 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform the following field quality-control testing:

B. Testing: Test pull-out resistance of seismic anchorage devices.
   1. Provide necessary test equipment required for reliable testing.

2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless post-connection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to the structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. If a device fails the test, modify all installations of same type and retest until satisfactory results are achieved.
7. Record test results.

END OF SECTION 26 05 70

SECTION 26 20 00 LOW-VOLTAGE ELECTRICAL DISTRIBUTION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Conditions of the Contract Documents and Division 1 - General Requirements as applicable, apply to this Section.

1.2 SUMMARY

A. Provide all electrical distribution and motor control equipment and accessories required to distribute electrical power to all motors, outlets and systems requiring power.

1.3 QUALITY ASSURANCE

A. New: Provide all new equipment.

B. Single Manufacturer: All equipment of each type shall be the product of one manufacturer.

C. UL: Equipment shall be UL listed. Service entrance equipment shall bear UL Service Entrance label.

D. CEC: Equipment and installation shall comply with the California Electrical Code.

E. Wet Locations: Equipment and enclosures installed outdoors and in wet locations shall be approved for the purpose.

F. IEEE: Institute of Electrical and Electronics Engineers Standard 1015-1997 (Blue Book) Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems.

1.4 LABELING

A. Nameplates and labeling shall be provided in accordance with Section 26 05 53. All feeders shall be labeled at the feeder device.

1.5 FINISHES

A. All equipment shall have a factory applied gray finish applied over a rust inhibiting treatment. Any items which have the finish marred shall be touched up or refinished to a new condition before final acceptance. This shall include, but shall not be limited to, sanding and properly removing rust or other contaminants and completely repainting equipment if damage is extensive. Overall acceptance is subject to approval of the Engineer.

1.6 SUBMITTALS

A. Provide complete product data for each equipment type. Provide electric service studies when required.

B. Submittal shall include written recommendation from manufacturer of settings for all electronic trip adjustment setting on all equipment furnished with adjustable trip settings. Contractor is responsible for adjusting all electronic trip settings per manufacturer

recommendations.

C. Electrical connections to all equipment furnished by any other division shall be coordinated with final approved equipment submittals from other divisions including but not limited to circuit breaker sizes, conduit sizes, wire sizes, fuse sizes, disconnect switch sizes and starter sizes that differ from those shown on the drawings prior to submitting Electrical Distribution Equipment submittal.

1.7 SHORT CIRCUIT CURRENT RATINGS

A. General: All switchboards and panelboards shall be fully rated and marked with a maximum short circuit current rating. The equipment manufacturer shall have verified this rating with high-amperage testing. All short circuit current ratings are expressed as amperes RMS symmetrical at the applied voltage unless otherwise noted. All equipment shall withstand the specified level of fault current. All overcurrent devices shall interrupt the specified level of fault current.

1.8 ELECTRIC SERVICE STUDIES

A. Standard: Submit studies in accordance with ANSI/IEEE Standard 242 Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems.

B. Submit one-line diagram for each electrical service. Key all equipment and components on diagram to items in the studies.

C. Provide a short-circuit current analysis for each main switchboard. Short-circuit analysis shall calculate short-circuit levels at service transformer secondary, switchboard main breaker, each feeder breaker and all levels of downstream distribution equipment. Assume infinite source bus.

D. Provide a time-current coordination study for each main switchboard. Coordination study shall compare the operating levels and times of the protective devices to the withstand levels and times that the equipment can sustain without damage or failure. Determine electronic trip unit settings necessary to achieve optimal selective coordination between 208 volt main service circuit breaker and first level of feeder distribution devices. Determine setting for all adjustments of trip units of all electronic circuit breakers that are linked by zone-selective-interlocking. Furnish time-current curves for the two (or more) levels of distribution protected with electronic trips, plus the first additional distribution level served from the switchboard feeder. Show a separate composite plot for each feeder breaker trip rating with the main breaker. Plot composite time-current curves on log-log background. Add a typical frame size of downstream molded-case circuit breaker to each switchboard feeder composite plot.

E. Contractor shall make all adjustments to circuit breakers per electric service study and provide written documentation that all adjustments have been made.

1.9 OWNER'S INSTRUCTION

A. Provide a four-hour period of instruction to the Owner's designated personnel upon completion of the main switchboards' installation. Review manufacturer's recommended switchboard maintenance. The Operations and Maintenance Manual shall be complete and on-site at the time of Owner instruction.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Unless indicated otherwise, all equipment in this section shall be provided from a single manufacturer. The product designations listed are to establish a level of quality. Acceptable manufacturers are:
   1. Square D
   2. Siemens
   3. G.E.
   4. Cutler-Hammer

2.2 ENCLOSED SWITCHES

A. General: Provide heavy duty enclosed switches similar to Square D Class 3100 Type HD.

B. Switch Interior:
   1. All switches shall have switch blades which are visible when the switch is “OFF” and the cover is open.
   2. Lugs shall be front removable and UL Listed for 75 degrees Celsius conductors.
   3. All current carrying parts shall be plated to resist corrosion.
   4. Switches shall have removable arc suppressors to facilitate easy access to line side lugs.
   5. Switches shall have provisions for a field installable electrical interlock.

C. Switch Mechanism:
   1. Switch operating mechanism shall be quick-make, quick-break such that, during normal operation of the switch, the operation of the contacts shall not be capable of being restrained by the operating handle after the closing or opening action of the contacts has started.
   2. The operating handle shall be an integral part of the box, not the cover.
   3. Provisions for padlocking the switch in the OFF position with at least three padlocks shall be provided.
   4. The handle position shall travel at least 90 degrees between OFF and ON positions to clearly distinguish and indicate handle position.
   5. All switches shall have a dual cover interlock mechanism to prevent unintentional opening of the switch cover when the switch is ON and prevent turning the switch ON when the cover is open. The cover interlock mechanism shall have an externally operated override, but the override shall not permanently disable the interlock mechanism. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.

D. Switch Enclosures:
   1. Switch covers shall be attached with welded pin-type hinges.
   2. The enclosure shall be finished with gray baked enamel paint which is electrodeposited on cleaned, phosphate pre-treated steel.
   3. The enclosure shall have ON and OFF markings stamped into the cover.
   4. The operating handle shall be provided with a dual colored, red/black position indication,
   5. All switches shall have provisions to accept up to three (3) 3/8-inch hasp padlocks to lock the operating handle in the OFF position.
   6. Tangential knockouts shall be provided to facilitate ease of conduit entry.

E. Switch Ratings:
   1. Switches shall be horsepower rated for ac and/or dc as indicated on the plans.
   2. The UL Listed short circuit current rating of the switches shall be 200,000 rms

symmetrical amperes when used with or protected by Class J fuses.
3. Non-Fusible: 10,000 rms symmetrical amps.

F. Fuse Clips: NEMA FU 1, Class J fuses.

2.3 SINGLE CIRCUIT BREAKERS WITH ENCLOSURES

A. Product Description: Enclosed, molded-case circuit breaker conforming to NEMA AB 1, suitable for use as service entrance equipment where applied.

B. Circuit Breakers: Molded case, quick make, quick break, trip free, common thermal magnetic trip.

C. Ratings: Continuous current, poles as required, 480-volt system breaker shall interrupt short circuits up to 18,000 rms amps symmetrical; on 120/208 - 240 volt system, minimum 10,000 amp rms symmetrical or as specified on drawings whichever is higher.

D. Enclosure: NEMA AB 1, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard gray enamel.
1. Interior Dry Locations: Type 1.
2. Exterior Locations: Type 3R.

E. Nameplate: Provide a nameplate showing load served.

2.4 FUSES (600 VOLTS AND BELOW)

A. Manufacturers:
1. Bussmann.
2. Little Fuse
3. Ferraz Shawmut

B. Dimensions and Performance: NEMA FU 1, Class as specified or as indicated on Drawings.

C. Voltage: Rating suitable for circuit phase-to-phase voltage.

D. Class J (Time Delay) Fuses
1. Dimensions and Performance: NEMA FU 1.
2. Voltage: Rating suitable for circuit phase-to-phase voltage.
3. Dual-element, time delay ten (10) seconds (minimum) at 500 percent rated current.

E. Spares: Spare fuses shall be provided in the amount of ten (10) percent of each type and size installed. Replacement for fuses and limiters blown during construction shall not count as spares.

2.5 DISTRIBUTION PANELBOARDS

A. Manufacturers: Square D I- Line, Class 2110.

B. Product Description: NEMA PB 1, circuit breaker type panelboard.

C. Panelboard Bus: copper current carrying components, ratings as indicated on Drawings. Furnish copper ground bus in each panelboard.

D. Continuous current rating shall be sufficient to protect wiring and equipment served.
1. Panels 400A and smaller, 35,000 amperes rms symmetrical.

2. Panels greater than 400A: 65,000 amperes rms symmetrical.

E. Molded Case Circuit Breakers: NEMA AB 1, circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Furnish circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.

F. Main Circuit Breaker:
1. When distribution panel has main circuit breaker, provide molded case circuit breaker with electronic trip unit. Current sensing to be true-rms.
2. Main breaker shall have minimum interrupting rating of 65,000 amperes rms symmetrical at applied voltage.
3. Electronic trip shall be Square D micrologic with adjustable long-time, short-time and instantaneous pick-up set points.

G. Cabinet Front: Safety dead front type. Conform to NEMA 1; NEMA 3R if located outdoors. All panelboards located in kitchen areas shall be flush mount with NEMA 4X Stainless Steel enclosures.

2.6 BRANCH CIRCUIT PANELBOARDS

A. Manufacturers: Square D Type NQ for 208/120V, type NF for 480/277V.

B. Product Description: NEMA PB1, circuit breaker type, lighting and appliance branch circuit panelboard.

C. Panelboard Bus: Copper current carrying components, ratings as indicated on Drawings. Furnish copper ground bus in each panelboard;

D. For non-linear load applications subject to harmonics furnish 173 percent rated, plated copper, solid neutral.

E. Minimum Integrated Short Circuit Rating: 14,000 amperes rms symmetrical for 208-240/120 volt panelboards; 22,000 amperes rms symmetrical for 480 volt panelboards or as specified on drawings whichever is higher.

F. Molded Case Circuit Breakers: NEMA AB 1, bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles, listed as Type SWD for lighting circuits, Type HACR for air conditioning equipment circuits, Class A ground fault interrupter circuit breakers as indicated on Drawings. Do not use tandem circuit breakers.

G. Enclosure: NEMA PB 1, Type 1 or Type 3R. All panelboards located in kitchen areas shall be flush mount with NEMA 4X Stainless Steel enclosures.

H. Cabinet Front: Safety dead front type with concealed trim clamps, concealed hinge, metal directory frame, and flush lock keyed alike. Finish in manufacturer's standard gray enamel.

I. Provide ground-fault circuit breaker for each heat trace branch circuit.

J. Panelboards indicated to have thru-feed lugs shall be furnished with thru-feed lugs in all sections of panelboard.

2.7 MAIN SWITCHBOARDS:

A. General: Provide universal building–type switchboards fabricated in accordance with NEMA Standard PB–2, UL Standard 891, and bearing a UL Service Entrance Label. Switchboard

characteristics are 280/120 volts, 3 phase, 4 wire. Main connection and unit-mounted branch connections shall be from the rear. Group mounted branch connections shall be from the front or the rear. The entire switchboard assembly shall be similar to Square D Type QED-2. Provide with NEMA-3R weather enclosure.

B. Structure:
1. The switchboard shall be freestanding and have front and rear alignment. Provide rear access to main device(s) and all unit-mount branch devices (2000A and less can be front access only). Provide front or rear access to group-mounted devices. Formed up steel channels bolted together to form a rigid structure to which formed up fronts, side sheets, and rear covers are bolted. Galvanized 1–1/2" x 3" mounting channels on bottom, rear, left, and right sides to close all openings at the bottom. Arrange for easy addition of future cubicles at end. Provide pull box, fabricated with unit at factory, on top of switchboard if required for proper entrances and exits of feeders.
2. When “SPACE” is indicated on one-line diagram, provide full bussing extension to serve that space and all overcurrent device mounting hardware for the given frame size.

C. Installation: Freestanding, level and bolted to a four (12) inch concrete pad.

D. Instrumentation:
1. General: Monitor the incoming line with a meter per power company standards.
2. Wiring Lugs: Provide ring lugs for all wiring terminations of potential transformers (PTs), current transformers (CTs) and current sensors. Fork lugs are not acceptable. Ring lugs are intended to minimize the chance of leads pulling apart and creating an open circuit. (Zero current reading).

E. Phase, Neutral and Ground Bussing: Silver plated 98% conductivity copper sized to comply with NEMA Temperature Rise Standard. In addition, copper bus shall be sized on the basis of a maximum temperature rise of 65 degree C. The vertical bussing per cubicle shall be sized not less than the sum of all devices, including spare spaces, to be served from that cubicle. **The vertical bus shall be a minimum of 1600 amperes and shall be full height**. Bus supports, connections, and joints shall be bolted with SAE Grade 5 medium carbon steel bolts employing Belleville washers. Provide complete bussing, mounting provisions for circuit protective devices and space screw cover wherever the drawings indicate space only. Arrange and drill bussing for **future full capacity extension**. Provide a full length ground bus, with minimum ampacity of 1/3 phase bus ampacity. Provide full–size neutral rated at 100 percent of phase bus.

F. Terminations: Provide proper incoming line lugs to accommodate cable shown on plans.

G. Short Circuit Ratings:
1. Switchboard assembly of protective devices, together with the bussing and bracing, shall be fully-rated to withstand and interrupt short circuits on a system capable of delivering up to **65,000 amps RMS** symmetrical at nominal system voltage.

H. Protective Devices:
1. Switchboard Main Breaker:
a. Stationary mounted, manually operated, 100 percent rated molded case circuit breakers with electronic tripping system and stored energy closing mechanisms. The electronic tripping system shall be similar to Square D Micrologic Full Function Trip unit. Main breakers shall be as noted on drawings.
b. The breaker shall be UL Listed for continuous duty at 100% of the current rating.

~~c.~~ Minimum interrupting rating of 65,000 amperes rms symmetrical at 208Y/120 Volts.
d. Local trip indicators: overload, short circuit and ground fault.
e. Electronic sensing systems shall be true-RMS sensing and not susceptible to adverse harmonic current effects.
f. Adjustments:
1) The electronic trip unit shall have LSIG Trip functions.

2. Feeder Devices:
a. Breakers 700 Amps and Larger:
1) Branch feeder breakers 700 amp and larger shall be molded case circuit breakers rated 100% with electronic trip units, similar to Square D [RJ (1600-2500A 65kaic 100%)], [PJ (700-1200A 65kaic 100%)].
2) Interrupting rating shall be at least 65,000 amperes rms symmetrical at 208Y/120 Volts.
3) The electronic trip unit shall have LSI trip functions.
4) The breaker shall be UL Listed for continuous duty at 100% of the current rating.
b. Breakers 600 amps and smaller shall be type L (600A and 400A frame), J (250A frame), and H (150A frame) molded circuit breakers, AIC rating to match main breaker.
c. The breaker shall be UL Listed for continuous duty at 100% of the current rating.

I. Transient Voltage Surge Suppressor (TVSS):
1. General: Provide a Square D Class 1310 240kA surge current rated mounted in the switchboard mounted above the main circuit breaker compartment.

J. Lightning and Overvoltage Surge Arrester:
1. General: Provide a Square D SDSA3650 lightning and overvoltage surge arrester inside the switchboard housing, connected between the service entrance bussing and the ground bus.
2. Description: Device shall be a heavy duty, three–phase, zinc metal oxide varistor (MOV), secondary class arrester rated for 650 volts and U.L. listed in Category (OWHX) of the Electrical Construction Materials Directory (Green Book). Device shall comply with ANSI/IEEE C62.11-1987 Standard for Metal Oxide Surge Arresters for AC Power Circuits.
3. Installation shall comply with NEC Article 280. Provide fusing if required by installation instructions from arrester manufacturer.

K. Identification:
1. General: Identify each device and meter with a nameplate showing load served. Refer to LABELING in Section 26 05 00.
2. Master Nameplate: Provide a master nameplate on face of boards similar to following, with correct data shown:

Main Switchboard_____
208/120 Volts, 3 Phase, 4 Wire, 60 Hertz
Main Bus:___amps. braced for___ RMS sym. amps.
Date Installed:

L. Submittal: Include at least the following:
1. Manufacturer and Model Numbers
2. Dimensions
3. Cable Termination Provisions
4. Current Ratings
5. Voltage Ratings
6. Short Circuit Ratings
7. Protective Device Ratings

8. Electronic metering system
9. Surge Arrester
10. Unit Elevation
11. Bussing Schematic, Sizes and Statement of Conductor and Plating Materials
12. Original Manufacturer Brochure and Specifications
13. Coordination drawing using dimensions of actual switchboard submitted. Show board footprint, proper clearances, and other equipment in same room.

M. Testing: Test all devices and systems to assure proper operation.

PART 3 EXECUTION

3.1 MOUNTING:

A. General: All equipment shall be securely fastened in place.

B. Locations: In all cases mounting locations shall comply with the requirements of the California Electrical Code. This shall include providing suitable working clearances.

C. Concrete Pads:
1. Provide concrete in accordance with the Division of the Specifications for that product.
2. Indoor concrete pads shall consist of a four (4) inch pad with beveled edges extending two (2) inches beyond the perimeter of supported equipment. Switchboards shall be installed on a pad. Refer to the drawings and the specifications for each piece of equipment to determine what other equipment shall be mounted on a pad.
3. All equipment, ground mounted outdoors, shall be mounted on a pad. Outdoor pads shall be minimum of one foot thick reinforced with #4 rebar one (1) foot on center each way. Size outdoor pads with at least four (4) feet working clearance in front of equipment and one (1) foot on all sides. Provide anchor bolts for pad-mounted equipment. Refer to Detail on drawings.

D. Wall Mounted Equipment: Wall mounted equipment shall be suitably positioned on the wall. Equipment mounted on exterior basement wall shall have Unistrut channels between the wall and the equipment to prevent condensation problems. Where wall mounted equipment is specified, but a convenient wall not available, a suitable Unistrut mounting stanchion anchored in concrete shall be provided. In lieu of this stanchion, small devices may be mounted on to the equipment served if approved by the equipment manufacturer.

E. Motor rated disconnects: Install disconnects in a vertical orientation with off in the down position.

3.2 DELIVERY, STORAGE AND HANDLING:

A. General:
1. Store all types of electrical power distribution equipment in a clean, heated building affording appropriate physical protection. Control access to prevent unauthorized tampering with the equipment. However, equipment may be stored in other inside or outside environments under approved conditions.
2. Inspect equipment when received at Project site for shipping damage. Report as required by freight carrier to recover repair or replacement costs from the freight carrier in the event damage was sustained.
3. Covers are required unless indoor, ventilated storage conditions exist. Canvas tarpaulins or the equivalent are preferred over other coverings because they provide better humidity control and enclosure scuff protection. Where exposed to moisture, covers shall be waterproof.

4. The manufacturer's shipping skids shall be left on the equipment to provide structural support until the equipment is set in final resting place.
5. Refer to Section 26 05 00 for additional requirements. Contractor shall furnish new equipment to replace any equipment that is exposed to weather or subjected to other deleterious effects of construction.

B. Approved Conditions for Equipment Storage:
1. General: Where storage conditions specified above are not available, indoor or outdoor storage shall comply with the following.
2. Switchboards, and Other General Distribution and Utilization Equipment:
   a. Store metal-enclosed equipment in the upright position. Provide good ventilation of the shelter and protection from dirt, moisture and physical damage.
   b. Space heaters furnished with the equipment shall be connected to a continuous source of power of the proper rating. Where space heaters are supplied from auxiliary power transformers, care shall be taken that low-voltage heater circuits are properly isolated before power source connection to prevent inadvertent energizing of the auxiliary transformer and associated high-voltage primary wiring.
   c. Ambient conditions may allow condensation inside waterproof covers. If condensation is occurring, temporary heaters or lamp banks shall be provided of sufficient wattage to prevent condensation.
   d. Contractor shall ensure that equipment stored in shipping cases receives adequate ventilation to avoid mildew and prevent condensation.

3.3 GROUND FAULT PROTECTION OF EQUIPMENT:

A. General: Provide for system performance testing as required by the California Electrical Code. Provide each ground fault relay, sensing device or ground fault protection system with instructions and a test form. The form shall be retained by those in charge of the building's electrical installation and be available to the authority having jurisdiction. The instruction content shall be as required by UL.

3.4 LABELING:

A. Nametag: Provide a nametag for each piece of distribution equipment; see Section 26 05 53, Electrical Identification.

END OF SECTION 26 20 00

SECTION 26 27 26 WIRING DEVICES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section Includes:
   1. Wiring devices.

B. Related Sections:
   1. Section 26 05 00: Common Work Results for Electrical.
   2. Section 26 05 19: Low-Voltage Electrical Power Conductors and Cables.
   3. Section 26 05 26: Grounding and Bonding for Electrical Systems.
   4. Section 26 05 33: Raceway and Boxes for Electrical Systems.

PART 2 PRODUCTS

2.1 RECEPTACLES

A. General - All receptacles shall be listed by Underwriters Laboratories, Inc.:
   1. Mounting straps shall be plated steel, with break-off plaster ears and shall include a self- grounding feature (this feature does not substitute for a grounding conductor terminated on grounding strap of device). Terminal screws shall be brass, brass plated or a copper alloy metal.
   2. Receptacles shall be of a screw terminal type, “pressure type quick wire” terminations are not allowed.

B. Duplex receptacles shall be premium specification grade single phase, 20 ampere, 120 volts, 2-pole, 3-wire, and conform to the NEMA 5-20R configuration in NEMA WD 6. The duplex type shall have bussing break-off feature for two-circuit operation. The ungrounded pole of each receptacle shall be provided with a separate terminal:
   1. Wiring device color shall be standard white. Contractor to verify device color with Architect prior to procurement.
   2. Ground Fault Interrupter Duplex Receptacles - Shall be an integral unit suitable for mounting in a standard outlet box:
      a. Ground fault interrupter shall be commercial grade and consist of a differential current transformer, solid state sensing circuitry and a circuit interrupter switch. It shall be rated for operation on a 60 Hz, 120 volt, 20-ampere branch circuit. Device shall meet CEC requirements. Device shall have a minimum nominal tripping time of 1/30th of a second. Devices shall meet UL 943.

C. Receptacles; 20, 30 and 50 ampere, 250 volts: Shall be complete and match with appropriate cord grip plug. Devices shall meet UL 231.

D. Weatherproof Receptacles: Shall consist of a listed weather resistant duplex receptacle, mounted in box with a gasketed, while in use weatherproof, cast metal cover plate and cap receptacle opening. The cap shall be permanently attached to the cover plate by a spring-hinged flap. Approved manufacturers: Intermatic WP10 Series, Thomas & Betts/Red Dot 2CK Series, or engineer approved equal.

E. Approved receptacles are Hubbell HBL5352 Series, and Hubbell GF20, GFCI Series.

2.2 SWITCHES

A. Toggle switches shall be totally enclosed tumbler type with bodies of phenolic compound. Toggle handles color to match receptacle device color unless otherwise specified. Approved toggle switch is Hubbell SB120:
   1. Shall be single unit toggle, butt contact, quiet AC type, heavy-duty general-purpose use with an integral self-grounding mounting strap with break-off plasters ears and be of a screw terminal type.
   2. Shall be color coded for current rating, listed by Underwriters Laboratories, Inc., and meet the requirements of NEMA WD 1, Heavy-Duty and UL 20.
   3. Ratings:
      a. 120 volt circuits: 20 amperes at 120-277 volts AC.
      b. 277 volt circuits: 20 amperes at 277 volts AC.
   4. The switches shall be mounted on the strike plate side of doors.
   5. Incorporate barriers between switches with multi-gang outlet boxes where required by the CEC.
   6. All toggle switches shall be of the same manufacturer.
   7. Key lockable switches shall be Hubbell HBL122 Series.

2.3 WALL PLATES

A. Wall plates for switches and receptacles shall be type 302 stainless steel.

B. Standard NEMA design, so that products of different manufacturers will be interchangeable. Dimensions for openings in wall plates shall be accordance with NEMA WD1.

C. For receptacles or switches ganged together, wall plates shall be a single ganged plate.

D. Wall plates for data, telephone or other communication outlets shall be as specified in the associated specification.

E. Surface mounted boxes, NEMA1, shall be industrial grade raised galvanized steel covers. In shop areas, all receptacles shall be dust proof and or waterproof where applicable.

F. Waterproof device covers shall be cast iron, 4-corner screw type, for FS and FD type mounting. Device covers shall be zinc galvanized finish. Weatherproof covers shall be lockable.

PART 3 EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with the CEC, NECA “Standard of Installation”, and as shown as on the drawings.

B. Ground terminal of each receptacle shall be bonded to the outlet box with an approved green bonding jumper, and also be connected to the green equipment grounding conductor.

C. General: Devices shall be of the type specified herein. All devices shall be installed with “pigtailed” leads from the outlet box. No device shall be used in the “feed through” application. Screw terminals shall be used to connect all devices to the circuit and shall be grounded by means of a ground wire where grounding terminals are provided in the device.

D. Installation: Devices and plates shall be installed in a “plumb” condition and must be flush with the finish surface of the wall where boxes are recessed.

E. Mounting heights: All control and convenience devices shall comply with California Code of Regulations Title 24 and ADA with respect to accessibility requirements. Mounting heights indicated on plans shall have precedence.

F. Install switches with the off position down.

G. Clean debris from outlet boxes.

H. Provide extension rings as required to bring outlet boxes flush with finished surface or casework.

I. Test each receptacle device for proper polarity.

END OF SECTION 26 27 26

SECTION 26 50 00 - 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 interior luminaires, lamps, ballasts, and accessories. Provide all luminaries complete with all new lamps, completely wired, controlled, and securely attached to supports.

1.3 SUBMITTALS

A. Product Data: Submit dimensions, ratings, and performance data.

B. Photometric data for each luminaire, lamp and ballast. Include indications of all options and accessories as well as finish color.

C. Specification Review: A complete item by item, line by line specification review.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:
1. Provide luminaires listed by U.L.
2. Luminaires installed in outdoor areas unprotected from weather to be U.L. Listed for wet locations.
3. Insulated ceilings: Luminaires installed into insulated ceilings shall be U.L. Listed Type IC.

B. Certification: Certify that fixtures submittal have trim compatible with ceilings being installed.

C. Concrete for outdoor lighting poles foundations shall be provided per Section 03 30 00 - Concrete.

1.5 EXTRA MATERIALS

A. Provide extra materials for Owners use. All parts shall packaged in suitable carton.

B. Provide two (2) spare drivers for each fixture type. Deliver to Owner in original packaging.

PART 2 - PRODUCTS

2.1 LUMINAIRES

A. Product Description: Complete luminaire assemblies, with features, options, and accessories as scheduled.

B. All luminares shall be new and of specification grade.

C. Manufacturer nomenclature in fixture schedule or otherwise described on the Drawings is given only to show the general fixture series. Contractor shall provide fixture with all required accessories and mounting frame type.

D. Wire guard at fixtures in mechanical, electrical, and high abuse areas.

E. Acceptable Manufacturers:
1. Lightolier
2. Acuity
3. Metalux
4. Day-Brite
5. Columbia
6. HE Williams

2.2 LED LUMINAIRES

A. Quality Assurance
1. DOE Lighting Facts certified.

B. LED Specifications
1. Lumen maintenance of the LEDs has been tested in accordance with IESNA LM-80-08 reporting methodology.
2. CRI:>82 minimum (general); >90 healthcare and retail.
3. SDCM: <2.5 in linear pendants and linear recessed; <3.5 in discrete recessed.
4. R9: .0 (general office/school environments); >50 in healthcare and retail environments.
5. Outdoor luminaires to be rated at a minimum of 40^0 C.

C. Lumen Maintenance
1. Minimum L70 at 50K hours based on TM-21 Addendum A Lifetime report at an ambient temperature of 25^0 C, outdoors at an ambient temperature of 40^0 C.

D. Thermal Testing
1. ISTM testing in accordance to UL 1598-2008.

E. Driver
1. 0-10V enabled.
2. Output Class 2 rated.
3. Dimming range: 5-100%.
4. Constant current.
5. THD @ max load: <20%.
6. Power factor: >0.95
7. Environment protection rating: UL Damp and dry.
8. Approbations: certified to UL8750, UL1310, UL935, CSA-C22.2 No. 250.13-12, CSA 22.2 No. 223.

9. ROHS Compliant

F. Fixture photoetry
1. Conducted by a NVLAP accredited testing lab with IESNA LM 79-08.
2. System flux measured in delivered lumens.

G. Warranty
1. 5 year total system warranty.

2.3 EMERGENCY BATTERY PACKS

A. Provide Emergi-Lite FPSIU series, or approved equal, battery pack for fluorescent fixtures designated to have emergency battery back-up.

B. Fixture shall include lighted push button test switch installed in visible, accessible location adjacent to fixture.

C. Provide unswitched alternating current power source per manufacturer's instructions.

D. Provide connection to local switch where indicated on drawings, connect such that fixture can be controlled on/off from local switch without discharge of battery.

E. For fixtures designated to have emergency battery pack and be on a contactor controlled circuit, provide unswitched alternating current source ahead of contactor and wiring as required to allow automatic on/off control from the contactor without discharge of battery and local on/off switching where indicated.

F. Battery pack shall provide 1100 lumen output for 90 minutes per 2'x4' light fixture.

G. Provide integral battery pack for all exit signs where emergency generator power is not available. Battery pack shall provide minimum of 90 minutes output.

2.4 DOWNLIGHT FIXTURES

A. Provide recessed light fixtures with trim rings compatible with the ceiling material where fixture is to be installed.

2.5 EXIT SIGNS

A. Exit signs shall meet visibility requirements and be listed per UL 924 "Emergency Lighting and Power Equipment". Also shall meet Federal, State and Local Codes.

B. Chevron Directional Indicator: Provide Chevron per NFPA 101 Section 5-10.4.1.2.

C. Product Description:
1. LED Exit Sign:
a. Provide exit sign with Light Emitting Diodes (LED) illuminance source. Cover LED with diffuser.

D. Housing: Diecast aluminum with stencil face and matte white paint finish.

E. Input Voltage: 120/277 volt, dual input voltage, or self-illuminating, as per drawings.

F. EPA Energy Star Label.

G. Wire Guards: Install wire guard on all exit signs installed in gyms, lockers rooms, and athletic wing.

PART 3 - EXECUTION

3.1 EXISTING WORK

A. Disconnect and remove abandoned luminaires, lamps, poles and accessories.

B. Extend existing luminaire installation using materials and methods compatible with existing installation, or as specified.

C. Clean and repair existing luminaires to remain or to be reinstalled.

3.2 INSTALLATION

A. General: All luminaires shall have proper supports.

B. Install suspended luminaires using pendants supported from swivel hangers.

C. Locate recessed ceiling luminaires as indicated on Drawings.

D. Install surface mounted ceiling luminaires plumb and adjust to align with building lines and with each other. Secure to prevent movement.

E. Chain Hung: Unless otherwise indicated all fluorescent fixtures in Mechanical, Electrical and Elevator Equipment Rooms shall be chain hung. Verify exact mounting height with Architect before installing fixtures. Provide pendant hangers when equipment room has fire-resistive ceiling.

F. Suspended Ceilings:
1. Provide means of support for luminaires per CEC 410-36. T-bar clips shall be installed on the luminaire and shall be field secured to the inverted ceiling tees so that the luminaire is securely fastened to the ceiling system framing members.
2. Ceiling tiles shall not bear the weight of luminaires. Surface mount luminaires, recessed downlights, light track, exit signs, etc. shall be supported by proper frames or other attachment to main ceiling system grid or building structure above ceiling.
3. Luminaires shall be centered in ceiling tile.
4. Luminaire shall have flange or trim ring for closure of ceiling cutout or opening.
5. Fire-rated Ceiling Assembly: For Luminaires to be flush-mounted into a fire-rated ceiling or surface mounted to a fire-rated ceiling, install with independent, secure support. Raceway, cable assemblies, boxes and fittings located above a fire-rated floor/ceiling or roof ceiling assembly shall not be secured to, or supported by, the ceiling assembly including the ceiling support wires. Provide an independent means of secure support. Independent support wires shall be distinguishable by color, tagging, or other effective means from those that are part of the fire-rated design.

G. Verify weights and recommended mounting methods of all luminaires with manufacturers. Furnish and install supports. Luminaires weighing more than 30 pounds shall be supported independently of the outlet box.

3.3 LOCATIONS

A. Luminaires shown on the Electrical Drawings represent general arrangements only. Refer to Architectural Drawings and to Architect on jobsite for more exact locations. Coordinate location with all other trades before installation. Coordinate all light fixtures in Mechanical Rooms with the final installed piping and ductwork layouts. Adjust fixture mounting height and location if required so that light output is not obstructed by piping and ductwork.

3.4 FIRE INTEGRITY OF CEILING PENETRATIONS

A. Where ceiling is part of a fire-rated assembly, maintain integrity of that assembly with methods given in Section Electrical Hangers and Supports. Obtain ceiling system UL Fire Resistance Directory Design Number from Architectural Drawings.

3.5 AIMING AND ADJUSTMENT

A. General: All adjustable lighting units shall be aimed, focused, and locked by the Contractor under the supervision of the Architect/Owner. All aiming and adjusting shall be carried out after the entire installation is complete.

3.6 LAMPS

A. Clean all lamps after installation.

3.7 CLEANING

A. Lens: Clean lenses of all luminaires after space is finished and prior to project acceptance.

END OF SECTION 26 50 00

SECTION 27 51 26 ASSISTIVE LISTENING SYSTEMS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Work included:
1. Provide assisted listening system as described herein.
2. Assistive-listening systems shall be provided in accordance with CBC Section 11B-219 and shall comply with CBC Section 11B-706.
3. Per CBC Section 11B-219.3, the minimum number of receivers to be provided shall be equal to 4% of the total number of seats, but in no case less than two, 25% minimum of receivers provided, but no fewer than two, shall be hearing-aid compatible in accordance with CBC Section 11B-706.3
4. If the system provided is limited to specific areas or seats, then such areas or seats shall be within a 50-foot viewing distance of, and have a complete view of, the stage or playing area, CBC Section 11B-219-4.

1.3 SUBMITTALS

A. Submit in accordance with Sections 01 33 00: Submittal Procedures and 26 05 00: Common Work Results for Electrical.

1.4 QUALITY ASSURANCE

A. The quantity of wireless headsets on-site shall satisfy the ADA requirement of 4% of the occupancy in the largest conference room and/or assembly area. Refer to architectural sheets for occupancy loads/types.

1.5 WARRANTY

A. The entire system shall be of one manufacturer and shall carry a 2-year (minimum) warranty. The system shall be as manufactured by Williams Sound Corp. or engineer approved equal.

PART 2 PRODUCTS

2.1 ASSISTED LISTENING SYSTEMS

A. Provide and install complete, ADA compliant Assisted Listening Systems as follows:
1. The campus shall have (as a minimum):
a. (1) Portable system consisting of a hard suitcase-style carrying case and containing:
1) (1) Battery operated, belt (clip) FM transmitter unit with lapel microphone.
2) (4) Battery operated, belt (clip) receivers with built in ambient (environmental) microphone and single (bud-style) earphone.
b. The portable systems shall be located in the Administration Office available for check out. Refer to Architectural specifications for signage requirements at conference rooms and assembly areas.

PART 3 EXECUTION

3.1 COMMISSIONING

A. Train Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, and servicing of the system. Provide a minimum of 2 hours of training. Operators Manuals and Users Guides shall be provided at the time of thistraining.

B. Schedule training with Owner through the Architect, with at least seven days advance notice.

END OF SECTION 27 51 26

SECTION 28 31 00 FIRE DETECTION AND ALARM

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section Includes:
1. Provide a complete, fully addressable, power limited, fire detection and voice evacuation system for this project. The system shall be connected, tested, verified by AHJ to be acceptable and left in first class operating condition. All equipment herein specified shall be engineer-approved and California State Fire Marshal (CSFM) listed. The entire installation shall conform to the National Fire Protection Association (NFPA) Standard 72, 2022 90A & CEC Article 760 and authorities having jurisdiction as applicable. The system specified and depicted on the plan is a complete and approved system. The entire fire alarm system has been submitted and approved by the Division of the State Architect as a complete submittal. Any routing of the system wiring that is significantly different than shown on the approved drawings shall have the approval of the engineer and must be obtained prior to construction.
2. Provide all work and material as shown and / or required to provide a fully functional and adequate system as described hereon and as required by the California State Fire Marshal.
3. Supervision: The fire alarm system shall monitor the integrity of all alarm initiating and indicating appliance circuits and provide local and remote status of all connected systems. The system shall be provided with automatically charged standby batteries to maintain system operation for 24 HRS in the normal supervisory mode and 15 minutes of alarm. Batteries shall be supervised for connection to the system and low voltage threshold. The automatic battery charger shall be capable of charging fully discharged system batteries to 100% in 8 hours.
4. The system wiring and installation shall be as stated in drawings and as required by the manufacturer. All wiring shall be color coded, tagged and verified to assure that it is free from shorts and grounds and shall be rated for the appropriate environmental conditions such as well locations.
5. Testing: The completed system shall be tested in accordance with NFPA Standard 72 7.6.6 and 7.8.2.
6. All Fire Alarm wiring shown in drawings shall be installed in conduit.
7. System Operation shall include:
   a. Separate zone signaling and device status indication for all initiating devices.
   b. Audible to sound the California uniform fire alarm signal in temporal mode. Devices shall be at least 15dBA above average ambient sound level, but not less than 75dBA at 10’ or more than 120dBA.
   c. Visual devices shall not exceed 2 flashes per second and shall not be slower than 1 flash per second. Visual devices shall be synchronized when 3 or more devices are within the same field of view.
   d. Supervision of all circuits to indicate any abnormal wiring condition.
   e. N.O./N.C. integral relays for external device interface or as indicated on drawings.
   f. Central station connection capable of indicating (3) distinct separate signals as being tamper, trouble and alarm with point reporting capabilities.
8. All work shall be completed as shown on the plans and or as specified within this specification and shall include the following (but is not limited to):
   a. Life safety fire alarm detection and signaling system.

b. Furnishing and installation of equipment and devices.
c. Conductors, connections and interconnections where specified and all in conduit system.
d. Conduit, wire and connections for control of heating and ventilation motors, smoke dampers and smoke exhaust.
e. Testing, cleaning and adjusting of completed work.
f. Wiring diagrams, as-built drawings and three (3) sets of equipment operations and maintenance instructions for Owner.
g. Complete maintenance for two years.
h. Proposal for subsequent maintenance contract.
i. All work and material for complete and operable systems as indicated or specified.
j. Permits, inspections and fees.
k. Identification and instruction to Owner Representative. Training shall consist of a minimum or two (2) 6-hour sessions.

9. Coordination with Section 26 05 33: Raceway and Boxes for Electrical Systems.
10. Furnishing of special back boxes where required for installation of fire alarm devices.
11. All conductors to be installed in conduit pursuant to Specification Section 26 05 33: Raceway and Boxes for Electrical Systems.
12. Qualifications: Contractor shall receive written approval and verified test results which shall be submitted to the owner for system from manufacturers recognized representative prior to completion and acceptance.
13. All initiating devices shall be separately addressed for individual identification at control panel.
14. As-Built Drawings: A complete set of reproducible “as-built” drawings showing installed wiring, color coding, wire tag notations exact locations of all installed equipment, specific interconnections between all equipment and internal wiring of the equipment shall be delivered to the owner upon completion of the system.
15. Maintenance Instructions: Three (3) submittals of maintenance instructions shall be provided and shall be complete, easy to read, understandable and shall provide the following information:
    a. Instructions for replacing any components of the system, including internal parts.
    b. Instructions for periodic cleaning and adjustments of equipment with a schedule of these functions.
    c. A complete list of all equipment and components with information as to the address and telephone number of both the manufacturer and local supplier of each item.
    d. User operating instructions shall be prominently displayed on a separate sheet located next to the control unit in accordance with UL Standard 864. The contractor shall warrant all equipment and wiring free from inherent mechanical and electrical defects for two years from the date of final acceptance.
16. The FACP shall integrate with the to prevent bells from activating during a fire alarm.
17. The FACP shall meet the requirements of UL ANSI 864 Ninth Edition. Systems listed to UL ANSI 864 Eighth Edition or earlier revisions are not acceptable.

B. Substitutions
1. Substitution of system components or manufacturer will require the contractor to separately obtain approval with DSA at Contractor’s expense and shall meet all requirements of the system as designed and pre-approved.
2. All proposed substitutions shall be listed with the California State Fire Marshal.

1.3 SUBMITTALS

A. Comply with applicable provisions of Section 26 05 00: Common Work Results for Electrical.

B. General:
1. Two (2) copies of all submittals shall be submitted to the Architect/Engineer for review and approval.

2. All references to manufacturers model numbers and other pertinent information herein is intended to establish minimum standards of performance, function, and quality.
3. For equipment other than that specified, the contractor shall provide proof that the proposed substitute equipment equals or exceeds the form, feature, function, performance, and quality of the specified equipment.

C. Product Data:
1. A complete list of all supplied equipment including model numbers with catalog data sheets on each component.
2. Data sheets show California State Fire Marshal Listing, U.L. listing, equipment ratings, dimensions and finishes.
3. Highlight actual devices to be used and their amp draw in stand-by and alarm modes.

D. Shop Drawings:
1. Provide schematic layout, floor plan, drawings indicating location of all components and equipment, required size and location of conduit and outlets and type and quantity of system conductors. Include voltage drop calculations and battery calculations based on actual number of devices to be installed.
2. Include riser and wiring diagrams for overall system and components including control panels, annunciators, power supplies, initiating circuits, notification appliances, control devices and FATC. Address numbers shall be noted on all appliances.
3. Include physical and electrical characteristics of equipment to indicate conformance with the Specifications.
4. Describe system characteristics and function as well as device wiring diagrams.
5. Voltage drop and battery calculations for each control panel and power supply and initiating circuits at 24 hour stand-by and 15 mins alarm.
6. System operational matrix.

E. Operating and Maintenance Instruction Manual:
1. Manual shall include the following tailored to this specific project:
   a. Operational description.
   b. Coded cabling plan.
   c. Two wire circuit diagrams.
   d. Wiring destination schedule.
   e. Schematic component diagrams and PC board layouts.
   f. Maintenance and alignment procedures.
   g. Voltage drop and battery calculations.

F. Other documentation

1. In addition to the shop drawings, the following information shall also be included with the submittal.

a. Manufacturer’s technical data sheets for each piece of equipment that will be installed.

b. Standby battery calculations for the FACP and any remote power supply or other panels that include their own standby batteries.

c. Voltage drop calculations showing the worst-case end of line voltage for all notification appliance circuits

d. Detailed description of the overall operation of the system or a sequence of operation matrix.

e. Proof of factory training and certification of the supervising technician assigned to the

project.

f. Proof of factory training and certification of a service technician employed by the installation company that can be onsite to troubleshoot and repair any service-related problems with the system, within 4 hours of being notified of the problem.

1.4 PERFORMANCE REQUIREMENTS

A. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded on NFPA Style 4 (Class B) Signaling Line Circuits (SLC).

B. Device Circuits (IDC) shall be wired Class A (NFPA Style D) as part of an addressable device connected by the SLC Circuit.

C. Notification Appliance Circuits (NAC) shall be wired Class A (NFPA Style Z) as part of an addressable device connected by the SLC Circuit.

D. On Style 6 or 7 (Class A) configurations a single ground fault or open circuit on the system Signaling Line Circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.

E. Alarm signals arriving at the FACP shall not be lost following a primary power failure (or outage) until the alarm signal is processed and recorded.

F. NAC circuits and control equipment shall be arranged such that loss of any one (1) NAC circuit will not cause the loss of any other NAC circuit in the system.

G. Two-way emergency telephone communication circuits shall be supervised for open and short circuit conditions.

H. The secondary power source of the fire alarm control panel shall be capable of providing at least 24 hours of backup power with the ability to power the system for an additional 15 minutes in an alarm condition, at the end of the 24-hour backup period.

I. Basic System Operation

1. When an off normal condition occurs (Alarm, Supervisory, or Trouble) the respective LED on the FACP shall illuminate.

2. A piezo sounder shall activate at the FACP during any off normal condition until the SILENCE button is pressed by an authorized user.

3. A Red LED shall illuminate when an alarm or pre-alarm condition exists.

4. An Amber (yellow) LED shall illuminate when a Supervisory or Trouble condition exists.

5. A backlit 4-line 40-character LCD screen shall display all messages that refer to an off-normal condition.

6. An Alarm condition shall have priority over all other signals.

7. The FACP shall include an event buffer that maintains the last 4,000 system events including a date and time stamp for each.

8. In response to a fire alarm condition, the systems notification appliances and relay-controlled output

circuits that are associated through programming with the device initiating the alarm, shall automatically activate. Additionally, the system shall notify an approved central station via dial-up, IP, or cellular means as deemed acceptable by the local Authority Having Jurisdiction (AHJ).

1.5 QUALITY ASSURANCE

A. Loads of Equipment and Components
   a. Follow IEEE Standard where applicable.
   b. Provide fuse protection for equipment and spare fuses.
   c. Design systems for operation at 120 volts, normal or emergency power as indicated, 60 Hz nominal input.
   d. Operating voltage dissipated by resistors shall not exceed 25% of ratings.
   e. Operating voltage of capacitors shall not exceed 80% of rated voltage.
   f. Operating loads and voltages on transistors and solid-state devices shall not exceed manufacturer's recommendation for normal full load operation.
   g. Use electronic components of types and rating commonly available from stock of established commercial distribution.

B. Regulatory Requirements
   1. The specifications and standards shall fully comply with the latest issue of the current code and standards.

   2. All requirements of the Authority Having Jurisdiction (AHJ).

The FACP and associated field devices system shall comply with the following Underwriters Laboratories Inc. (UL) USA listing standards as applicable.

1. No. 38 Manually Actuated Signaling Boxes
2. No. 50 Cabinets and Boxes
3. No. 864 Control Units for Fire Protective Signaling Systems
4. No. 268 Smoke Detectors for Fire Protective Signaling Systems
5. No. 268A Smoke Detectors for Duct Applications
6. No. 346 Waterflow Indicators for Fire Protective Signaling Systems
7. No. 464 Audible Signaling Appliances
8. No. 521 Heat Detectors for Fire Protective Signaling Systems
9. No. 1638 Private Mode Emergency and General Utility Signaling
10. No. 1971 Visual Notification Appliances

1.6 WARRANTY

A. For a period of two years from date of final acceptance, the system shall be under full guarantee for materials and labor at no cost to the Owner. The system shall be under a service contract with a technician authorized by the manufacturer. Replacement parts and labor shall be readily available during normal business hours while the service contract is in effect. A complete system inspection and test shall be performed at five months and again at eleven months after final acceptance. Tests shall include all smoke detector sensitivity settings.

B. Conform to applicable provisions of the General Requirements.

C. Service technicians and replacement components for the system shall be available locally from a service representative of the manufacturer who is able to provide evidence of technical training and authorization by the manufacturer.

D. All component failures shall be remedied to the satisfaction of the Owner.

E. A continuing service contract shall be offered at time of bid to commence at the expiration of warranty included with the system.

1.7 ACCEPTABLE MANUFACTURER

A. All fire alarm system devices and equipment shall be manufactured with the one indicated on the drawing or approved equivalent. no other manufacturers will be accepted.

B. All equipment, materials, accessories, devices, etc. covered by the specifications and/or noted on the contract drawings shall be new and unused and be UL. listed for their intended use.

C. All equipment provided shall be available for purchase from at least two authorized distributors within the service area.

1.8 MAINTENANCE:

Maintenance and testing shall be on a semi-annual basis or as required by the AHJ. A preventative maintenance schedule shall be provided by the contractor describing the protocol for preventative maintenance. The schedule shall include:

Systematic testing and complete inspection of the entire fire alarm system including control panels, field devices, and wiring terminations including smoke sensors, heat sensors, manual pull stations, sprinkler system switches, remote panels, power supplies, and terminal boxes, and all other fire alarm accessories, in accordance with NFPA 72. Cleaning and adjusting of these devices shall be conducted at this time.

An inspection and test of system power supplies, batteries, circuit breakers, and fuses as well as a load test of the batteries shall be conducted in accordance with NFPA 72.

Placing the system into an alarm condition and checking each notification device for proper operation.

Removing devices from the FACP SLC circuit to ensure a trouble condition occurs.

Input and output mapping shall be tested to ensure proper sequence of operation.

Signal transmission shall be tested to the Monitoring Station.

A report showing the calibrated sensitivity of each of the systems smoke detectors shall be generated from the fire alarm control panel and verified to ensure all smoke detectors are within UL tolerance.

Following each periodic maintenance and test, the owner shall be provided with a detailed report of the test results including any deficiencies found.

PART 2 PRODUCT

2.1 MANUFACTURERS

A. Fire Alarm Control Panel (FACP): Farenhyt by Silent Knight

B. Fire Alarm System Annunciator: Farenhyt by Silent Knight

C. Fire Alarm Amplifier: Farenhyt by Silent Knight

D. Fire Alarm Power Supply: Farenhyt by Silent Knight

E. Area Smoke Detectors, Multi-Criteria Fire/CO Detector and Heat Detectors: Farenhyt by Silent Knight

F. Strobes, Combination Speaker/strobe and Weatherproof Speaker: System Sensor

2.2 MATERIALS

A. Main FACP or network node shall contain a microprocessor based Central Processing Unit (CPU) and power supply in an economical space saving single board design. The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent addressable smoke and thermal (heat) detectors, addressable modules, printer, annunciators, and other system-controlled devices.

B. System Devices and components shall be provided as specified on the fire alarm equipment legend and as shown on associated electrical drawing.

2.3 COMPONENTS

NEW FIRE ALARM CONTROL PANEL (FACP)

A. FACP shall be as indicated model on the drawing or approved equivalent.

2.1 System description

A. The fire alarm system as outlined on the drawings, shall be a fire life safety system as manufactured by the panel indicated on the drawing. It shall be complete with all necessary hardware, software and memory specifically tailored for this project.

B. All equipment needed for a complete operable system, (whether specifically indicated or not) shall be included in this section. It shall be the installing contractor’s responsibility for a complete and operable system upon completion of this project.

2.2 Automatic alarm operations

A. The fire alarm system operation subsequent to the alarm initiation via pull station, smoke detector, heat detector, sprinkler flow switch, etc., shall be as follows:

1. All audible alarm indicating devices shall sound the temporal signal code in synchronization with each other, until silenced at the control panel or at the remote annunciator.

2. All visual alarm indicating devices shall flash per NFPA requirements in synchronization with each other, until reset at the control panel or at the remote annunciator.

3. Alarm audible devices and alarm visual devices shall operate on the same circuit

4. The alarm signals shall be inhibited from being silenced for a period of at least 1 minute after commencing operation. this rate is to be field programmable for actual AHJ requirements.

5. Display type and location of alarm per point on the main control panel lcd display.

6. Display type and location of alarm per point on remote lcd annunciator.

7. List on printer the time, date, type, and user defined message for each event printed.

8. Graphically display on the fireworks station, school diagram showing whole school, with graphic scrolling thru system prompts, down to point of alarm activation.

9. Subsequent alarms are to report to the main control panel and fireworks, shall indicate to the operator that a subsequent alarm is present, and also indicate the number of subsequent alarms.

10. Shut down all associated air handlers in alarm zone.

2.3 Automatic supervisory operation

A. All data, initiating, indicating and supervisory lines shall be constantly monitored for integrity. indicate opens, shorts, grounds, at main control panel and remote annunciator.

2.4 operation

A. During the normal state, the normal led (green) shall flash. the first line of the lcd shall display the time in (hh: mm: ss) as well as the number of active points (ap) and the number of disabled points (dp) in the system.

B. When the control panel goes into alarm condition, the normal led (green) extinguishes and the alarm led (red) shall light, the buzzer pulsates, and the lcd indicates the time, the number of messages waiting, the type of alarm, the point id number of devices, and the time that the alarm occurred. the second line is dedicated to the user specified message.

C. To silence the panel buzzer, the operator shall press the local silence button and the buzzer will silence.

D. To silence the audible devices, the operator shall press the alarm silence button. a new alarm shall cause the audibles to resound.

E. During the trouble condition, the amber trouble led shall light, the normal led shall go out, and the buzzer shall pulsate. the display shall indicate the point id number of the device, the time the event occurred and up to a 40-character custom user description.

F. During the monitor or supervisory condition, the appropriate led shall light, the normal led shall go out, and the buzzer shall pulsate. the display shall indicate the point id number of the device, the time the event occurred and up to a 40-character custom user description.

B. Fire Alarm Amplifier:

1. The intelligent fire alarm amplifier shall be as indicated model on the drawing or approved equivalent. The intelligent 50 or 70-watt amplifier is used to amplify the audio message for distribution throughout the facility. Since it is designed as a self-contained distributed amplifier it can be conveniently located near the area of protection to reduce wiring demands.
2. Each amplifier can produce 50 or 70 -watts of audio power. Up to four amplifiers can be used on the voice evacuation system. The amplifier has its own power supply with battery backup and four speaker circuits which can be expanded to eight speaker circuits. The amplifier is fully supervised by the main panel for trouble conditions.

C. Fire Alarm Power Module:
   1. The intelligent fire alarm power module shall be as indicated model on the drawing or approved equivalent. It delivers 6 amps of notification appliance circuit power and built-in synchronization. Its switch mode power supply design is up to 50% more efficient than competitive linear mode power supplies.
   2. The power supply is a 6-amp notification power expander that provides its own AC power connection, battery charging circuit, and backup battery for use with the same manufacturer series fire alarm control panels (FACPs). The power supply is the cost-effective solution for powering notification appliances required by the Americans with Disabilities Act (ADA). It has built-in ANSI cadence pattern. The output circuits can be programmed as notification appliance circuits, or as auxiliary power (configurable for constant, resettable, or door holder power).

D. Addressable Manual Fire Alarm Box (manual station)
   1. Addressable manual fire alarm boxes shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status. They shall use a key operated test-reset lock and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.
   2. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.
   3. Manual fire alarm boxes shall be constructed of Lexan with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1.75 inches (44 mm) or larger.

E. Intelligent Photoelectric Smoke Detector
   1. The intelligent photoelectric smoke detector shall be as indicated model on the drawing or approved equivalent and shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.

F. Intelligent Thermal Detectors
   1. The intelligent thermal detectors be as indicated model on the drawing or approved equivalent addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius) and have a rate-of-rise element rated at 15 degrees F (9.4 degrees C) per minute. A high heat thermal detector rated at 190 degrees Fahrenheit shall also be available. The thermal detectors shall connect via two wires to the fire alarm control panel signaling line circuit.

G. Control Relay Module:
   1. The Control Relay is intended for use in intelligent, two-wire systems where the individual address of each module is selected using the built-in rotary switches. It allows a compatible control panel to switch discrete contacts by code command. The relay contains two isolated sets of Form-C contacts, which operate as a DPDT switch and are rated in accordance with the table in the manual. Circuit connections to the relay contacts are not supervised by the module. The module also has a panel-controlled LED indicator.

H. Intelligent Monitor Module:
   1. The monitor module indicated on the drawing is an addressable monitor module for use with Honeywell Silent Knight Series fire alarm control panels (FACPs). The monitor module is intended for use in intelligent, two-wire systems, where individual address of each module is selected using the built-in rotary switches.
   2. It supports Class A supervised or Class B supervised wiring to the load device. Conventional 4-wire smoke detectors can be monitored for alarm and trouble

conditions.

I. Ceiling Mounted Strobe
1. The notification appliances shall be as indicated model or approved equivalent model as Visual Strobe appliances for ceiling-mount applications with a low-profile design or approved equals. The Strobes shall be listed for UL Standard 1971 (Emergency Devices for the Hearing-Impaired) for Indoor Fire Protection Service.
2. The Series shall be Restriction of Hazardous Substances (RoHS) compliant and contain no mercury or other hazardous substances.
3. All Series shall meet the requirements of FCC Part 15 and ICES-003.
4. All inputs shall be compatible with standard reverse polarity supervision of circuit wiring by a Fire Alarm Control Panel (FACP) with the ability to operate from 16 to 33 VDC.
5. The Strobe appliances shall produce a flash rate of one (1) flash per second over the Regulated Voltage Range and shall incorporate a Light Emitting Diode (LED) as the light source with a rugged Lexan® lens. The appliances shall be of low current design. The LED strobe flash duration shall be 20 ms. Where multi-candela appliances are specified, the strobe intensity shall have 4 field selectable settings at 15, 30, 75, 95 candela for ceiling-mount applications. The selector switch for selecting the candela shall be tamper resistant. Appliances with candela settings shall show the candela selection in a visible location at all times when installed.
6. The Strobe mounting options shall include Ceiling backboxes, 4” square, 1 1/2 or 2 1/8”deep and 4” Octagonal, 1 ½” or 2 1/8”deep. Two wire appliance wiring shall be capable of directly connecting to the mounting base. Removal of an appliance shall result in a supervision fault condition by the Fire Alarm Control Panel (FACP).
7. All notification appliances shall be backwards compatible.
8. The ceiling models shall have a low-profile measuring.
9. When synchronization is required, the appliance shall be compatible with Sync Modules, PS Power Supplies, or other manufacturer’s panels with built-in manufacturer Patented Sync Protocol. The strobes shall not drift out of synchronization at any time during operation. If the sync protocol fails to operate, the strobe shall revert to a non-synchronized flash-rate and still maintain (1) flash per second over its Regulated Voltage Range. The appliance shall also be designed so that the audible signal may be silenced while maintaining strobe activation when used with patented sync protocol.

J. Combination Speaker Strobes
1. The Speaker Strobes are designed for high efficiency sound output for indoor applications. The product line features intelligible communications with crisp, clear voice messages and tone signaling, ideal for mass notification and voice evacuation.
2. Providing a sleek aesthetic appearance, the wall and ceiling appliances feature dual voltage (25/70 VRMS) capability and field-selectable taps from 1/8 to 2 watts. For faster and easier installation, the low-profile design incorporates a speaker mounting plate, and each model has a built-in level adjustment feature and Snap-On cover with no visible mounting screws.
3. For visible signaling to meet the hearing impaired, the E Speaker Strobe models incorporate the low current draw of the Strobes.
4. Ceiling mount models are available in multi-candela ceiling strobe with field selectable intensities of 15/30/75/95/110/115cd or the high intensity strobe with field selectable 135/150/177/185cd.
5. The strobe portion of all Speaker Strobes may be synchronized when used in conjunction with the Sync Modules, Power Supplies or other manufacturers panels incorporating the manufacturer Patented Sync Protocol.
Synchronized strobes offer an easy way to comply with ADA recommendations concerning photosensitive epilepsy.
6. Speaker Strobes are UL Listed for indoor use under Standard 1971 (Signaling

Devices for the Hearing-Impaired) and Standard 1480 (Speaker Appliances). All inputs employ IN/OUT wiring terminals for fast installation using #12 to #18 AWG wiring.

7. The speakers shall be UL Listed under UL 1480 for Fire Protective Service and speakers equipped with strobes shall be listed under UL 1971 for Emergency Devices for the Hearing-Impaired. In addition, the strobes shall be certified to meet the requirements of FCC Part 15, Class A.
8. All models shall have listed sound output of up to 87 dB at 10 feet and a listed frequency response of 400 to 4000 Hz. The speaker shall also incorporate a sealed back construction.
9. The speaker and speaker strobe appliances shall be designed for indoor flush mounting. The speaker and speaker strobe shall incorporate a speaker mounting plate with a snap-on grille cover with no visible screws for a level, aesthetic finish and shall mount to standard electrical hardware. The finish of the Speakers and Speaker Strobes shall be red. All speaker and speaker strobe appliances shall be backward compatible.
10. When synchronization is required, the strobe portion of the appliance shall be compatible with sync modules or the Power Supplies with built-in Patented Sync Protocol. The strobes shall not drift out of synchronization at any time during operation. If the sync module or Power Supply fails to operate, (i.e., contacts remain closed), the strobe shall revert to a non-synchronized flash rate.

K. Weatherproof Speaker

1. Weatherproof notification appliances shall be UL listed for outdoor use. The appliances shall be available for optional wall mounting or ceiling mounting to weatherproof backboxes using either exposed conduit, concealed conduit, or semi-flush mounting to a recessed electrical box in walls or ceilings using indicated manufacturer mounting accessories.
2. Wall-mount outdoor speakers can be used indoors or outdoors in wet or dry applications, and can provide reliable operation from −40°F to 151°F. These speakers provide a broad frequency response range, low harmonic distortion and maintain a high sound pressure level at all tap settings to provide accurate and intelligible broadcast of evacuation messages.
3. Field-selectable settings, including candela, speaker voltage and power settings, and automatic selection of 12- or 24-volt operation enable installers to easily adapt devices to meet requirements.
4. Weatherproof audibles shall be System sensor models or approved equals. The speaker devices shall be able to produce a continuous output or a temporal code-3 output that can be synchronized.
5. Speaker shall be listed to Underwriters Laboratories Standard S4048 for outdoor fire protective signaling systems. Speaker shall have a frequency range of 400 to 4,000 Hz and shall have an operating temperature from –40°F to 150.8°F. Speaker shall have power taps and wattage settings that are selected by rotary switches. The speaker must be installed with its weatherproof back box in order to remain outdoor approved per UL listing S4048. The speaker shall be suitable for use in air handling spaces and wet environments.

L. Battery

1. The battery shall have sufficient capacity to power the fire alarm system for no less than twenty-four hours plus 15 minutes of alarm upon a normal AC power failure.
2. The batteries are to be completely maintenance free. No liquids are required. Fluid level checks for refilling, spills, and leakage shall not be required.
3. If necessary, to meet standby requirements, external battery and charger systems may be used.

M. Annunciator
1. Remote annunciator can be used to operate and program the FACP's.
2. The remote annunciator connects to the control panel. When the system is in normal operation and has AC power, the Power LED is lit, and all other LEDs are off. The other LEDs turn on as alarms, supervisory, troubles, and system silenced occur.
3. It can be surface or flush mounted.
4. Multi-panel displays can display the status and event history of all the panels they are assigned in a network.
5. UL listed, complies with NFPA 72.
6. Multi-panel annunciators will sound the highest priority tone from the panel it is assigned to.

PART 3 EXECUTION

3.1 COORDINATION

A. Refer to the electrical and mechanical drawings and specifications to determine quantities and location of devices and required scope of work and coordinate work with mechanical and electrical installers. Provide function described under mechanical section Sequence of Control, for fire and/or emergency conditions. Submit proposed interconnection to elevator supplier. Submit conduit and pathing requirements to electrical installer. For self-contained door release, coordinate with door supplier.

3.2 GENERAL

A. Comply with all applicable paragraphs in Section 26 05 00: Common Work Results for Electrical, apply as though repeated herein.

B. Install system(s) in accordance with manufacturer's instructions.

C. Include services of certified technicians to supervise installation, provide adjustments, provide final connections, system testing and system training to Owner Representative

3.3 INSTALLATION

The complete system shall be installed by one (1) contractor and the installing contractor must be a certified dealer of the specified system. No subcontractors, to the awarded proposing contractor, will be allowed to install any portion of this system Including, but not limited to:

1. Wiring
2. Field device installation
3. System programming
4. FACP installation
5. Remote power supply installation

A. The installing contractor shall install the network fire alarm system in as instructed by the manufacturer’s instructions.

B. Installation shall be in accordance with the 2022 CEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.

C. All conduit, junction boxes, conduit supports, and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this

period, measures shall be taken to protect smoke detectors from contamination and physical damage.

D. All fire detection and alarm system devices, control panels shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.

E. Manual fire alarm boxes shall be suitable for surface mounting or semi-flush mounting as shown on the plans and shall be installed not less than 42 inches (1067 mm), nor more than 48 inches (122 mm) above the finished floor.

F. The fire alarm control panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the main power distribution panel as FIRE ALARM. Fire alarm control panel primary power wiring shall be 12 AWG. The control panel cabinet shall be grounded securely to either a cold-water pipe or grounding rod. The control panel enclosure shall feature a quick removal chassis to facilitate rapid replacement of the FACP electronics.

3.4 GROUNDING

A. All equipment to be grounded by means of green ground wire to "U" contact of duplex receptacles and bonded to ground provided under 26 05 26: Grounding and Bonding of Electrical Systems.

3.5 INSPECTION

A. Systems to meet all the requirements of the CSFM and IOR and AHJ and shall be approved thereby before installation and prior to final acceptance.

B. Closeouts:
   1. It is the intent of these specifications and of the architect/engineer that a continued program of system maintenance be continued by the owner in compliance with NFPA Standard 72H. It is mandatory that the installing contractor provide such services and make available these services to the owner upon completion of the project.
   2. As part of the closeout documents, fire alarm contractor will provide owner with AutoCAD as built drawings indicating locations of devices, routing of wiring, and panel information. All room numbers indicated on final close out documents and all panel settings shall be listed by actual building room numbers and not by room number indicated on construction documents. CAD files shall be AutoCAD 2004 or later. Provide the owner with one Mylar plot of each drawing and two blue line prints of each drawing. Provide the owner with electronic versions of the as-built CD’s.
   3. Locate next to building FACP and other fire alarm panels.
   4. A building graphic shall be provided mounted in aluminum-extruded frame with plexi-glass front. Graphic shall locate all fire alarm devices, power supplies, and FACP.
   5. State FML-005 certificate shall also be framed and mounted near the fire alarm panel. Fire alarm panel shall have white FM required installation sticker attached to it.

C. Graphic shall include actual room numbers posted as part of the building graphics package, include as part of substantial completion requirement.

3.6 LOCATION

A. Before installation, verify exact location of control equipment and outlets.

3.7 WIRING

A. All fire alarm wiring shall be new.

B. Furnish all conductors, equipment, terminal strips, etc., and labor to install a complete and operable system. All cable conductors shall be color coded and numbered for identification at all terminals. Green shall be for grounding conductor only. Use red insulation and or red jacketing on all fire alarm cable.

C. All wiring shall be in accordance with NFPA 72, the California Electrical Code, Local Codes, and article 760 of NFPA Standard 70. All wiring sizes shall conform to recommendations of the equipment manufacturer, and as indicated on the engineered shop drawings.

D. All wire shall be U.L. Listed FPL for limited energy (300V) and fire alarm applications and shall be installed in conduit. Limited energy FPLP or MPP wire may be run open in return air ceiling plenums provided such wire is U.L. Listed for such applications and is of the low smoke producing fluorocarbon type and complies with CEC Article 760 if so, approved by the local authority having jurisdiction.

E. No A.C. wiring or any other wiring shall be run in the same conduit as fire alarm wiring.

F. Wiring used for the multiplex communication circuit (SLC) shall be twisted and support a minimum wiring distance of 10,000 feet when sized at 12 AWG. The design of the system shall permit use of IDC and NAC wiring in the same conduit with the SLC communication circuit. Shielded wire shall not be required.

G. The fire alarm control panel shall be capable of T-tapping NFPA Style 4 (Class B) Signaling Line Circuits (SLCs). Systems which do not allow or have restrictions in, for example, the number of T-taps, length of T-taps etc., is not acceptable.

H. Contractor shall provide a service loop located above each device installed on the entire project. The service loop shall be a minimum of 5’.

I. Contractor shall provide a service loop located above each type of panel installed. The service loop shall be a minimum of 10’, but shall have enough length to allow for the panel to be relocated to any wall within the room that panel is located in.

J. All service loops shall be installed in the accessible ceiling that is nearest to each device and panel. No service loops shall be installed in open spaces or non-accessible spaces

3.8 TERMINAL BOXES, JUNCTION BOXES AND CABINETS:

A. All boxes and cabinets shall be UL listed for their use and purpose.

3.9 CONDUIT / RACEWAY:

A. All wire shall be installed in an approved conduit/raceway system (except where permitted by NEC and the local authority having jurisdiction). Maximum conduit "fill" shall not exceed 40% per CEC.

B. Conduit and raceway system shall be installed as specified under the general electrical section of the specifications, and per CEC, local, and state requirements.

C. Minimum conduit size shall be 3/4" (19.1 mm). Install conduit per engineered shop drawings.

D. Systems utilizing open wiring techniques with low smoke plenum cable shall provide conduit in all inaccessible locations, inside concealed walls, all mechanical/electrical rooms, or other areas where wiring might be exposed or subject to damage.

E. All vertical wiring and all main trunk/riser wiring shall be installed in a complete raceway/conduit system. All riser boxes shall be adequately sized for the number of conductors traversing the respective box as well as the number of terminations required.

F. Cable must be separated from any open conductors of power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, per CEC Article 760-29.

G. Wiring for 24-volt DC control, alarm notification, emergency communication and similar power-limited auxiliary functions may be run in the same conduit as initiating and signaling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.

H. Conduit shall not enter the fire alarm control panel or any other remotely mounted control panel equipment or back boxes, except where conduit entry is specified by the FACP manufacturer.

I. All wiring associated with smoke control system shall be installed in conduit per current adopted codes regardless of voltages or ratings.

3.10 TESTING

A. After all equipment specified herein for each system has been installed and is in operating condition, conduct performance tests to determine if the installation and components comply with these specifications. Furnish competent personnel, all test material and approved test instruments and conduct the tests under supervision of factory personnel, in the presence of the Engineer, the building and fire inspecting agencies:
   1. The contractor’s job foreman, in the presence of a representative of the manufacturer, a representative of the owner, and the fire department shall operate every installed device to verify proper operation and correct annunciation at the control panel.
   2. At least on half of all tests shall be performed on battery standby power.
   3. Where application of heat would destroy any detector, it may be manually activated.
   4. The signaling line circuits and notification appliance circuits shall be opened in at least two (2) locations to verify the presence of supervision.
   5. When the testing has been completed to the satisfaction of the contractor representative IOR, representatives of the manufacturer and owner, a notarized letter co-signed by each attesting to the satisfactory completion of said testing shall be forwarded to the owner and the authority having jurisdiction.
   6. The contractor shall leave the fire alarm system in proper working order, and, without additional expense to the owner, shall replace any defective materials or equipment provided by him under this contract within two years from the date of final acceptance by the awarding authority.
   7. The local responding fire department must be notified prior to the final test in accordance with local requirements and when requested, participate in system testing and evaluation.

B. Intelligibility shall be tested according to NFPA 72 annex D.2 (speech intelligibility).

C. DSA, Architect/ Engineer and Owner shall be notified a minimum of 48 hours prior to the final inspection and/or testing.

3.11 WALK TEST

A. Notify Owner, Architect and Engineer when system is 100 percent operational. Schedule walk-through of the entire facility and verify that each initiating and each indicating device is operating properly.

B. Provide report at conclusion of walk through certifying all fire alarm devices are working.

C. Walk test shall include a representative from owner maintenance department.

D. Walk test to show in a printed report all AHU shutdown, strobes/horns, heat and smoke detectors. Report shall list all devices by approximate location to rooms, and device number.

3.12 SOFTWARE

A. Installer shall provide a backup copy of the installed program database (on CD) upon completion of the project. They shall also provide the current version of system software, for the panel provided, on CD.

3.13 REPORT

A. Prepare written report of final test results, signed by witnessing parties. Submit to the Engineer in triplicate for final approval.

END OF SECTION 28 31 00

SECTION 31 22 00 GRADING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes regulatory requirements, protection, site grading, excavation, backfilling, compaction, quality control, and restoration.

B. Reference Standards:
1. ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, using 5.5 lb (2.5 Kg) Rammer and 12-inch (300 mm) Drop.
2. ASTM D1556 - Test Method for Density of Soil in Place by the Sand-Cone Method.
3. ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb (4.5 Kg) Rammer and 18-inch (450 mm) Drop.
4. ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
5. ASTM C136 - Method for Sieve Analysis of Fine and Coarse Aggregates.

1.3 SUBMITTALS

A. In accordance with the requirements of Section 6705 of the Labor Code of the State of California, submit a detailed plan to the Engineer before excavation, 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 any trench or trenches 5 feet or more in depth.

B. Plan must be submitted and approved by the Owner and Engineer prior to start of work.

C. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

1.4 DEFINITIONS

A. Utility: Any buried pipe, duct, conduit, or cable.

B. Structure: Foundation, manhole, septic tank, cleanout, catch basin, vault, or culvert.

C. Solid Rock: Large continuous masses of igneous, metamorphic, or sedimentary rock, which in the opinion of the Engineer cannot be excavated without drilling and blasting. Soil that is capable of being excavated with rippers is not considered solid rock.

D. Loose Rock: Boulders and other detached stones, with a minimum volume of 1 cubic yard.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with Local Public Works Department public improvement standards.

B. Contractor shall assume sole and complete responsibility for locating all underground utilities and related facilities and for protection of the same during the course of construction.

PART 2 PRODUCTS

2.1 MATERIALS

A. Topsoil: See Section 31 23 23: Fill.

B. Other Fill Materials: See Section 31 23 23: Fill.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that survey benchmarks, control points, and intended elevations are as shown on drawings.

B. Verify the absence of standing or ponding water.
1. Provide temporary means and methods to remove all standing or ponding water from areas prior to grading.

3.2 PROTECTION

A. Barricade open excavations.

B. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

C. Provide safe conditions for workers and passers-by.

3.3 PREPARATION

A. Notify Underground Service Alert (800) 227-2600 in Northern California prior to excavation. Comply with their notice requirements.

B. Identify required lines, levels, contours, and datum locations.

C. Stake and flag locations of known utilities.

D. Protect plant life, lawns, rock outcropping, and other features remaining as final landscaping.

E. Protect benchmarks, existing structures, fences, and paving from excavating equipment and vehicular traffic.

F. Maintain and protect utilities and structures to remain.

3.4 EXCAVATION

A. Classification of Excavation:
1. All excavation with equipment commonly used in the industry is classified as common

excavation (except for drilling and blasting).

B. Use open cut method on all excavation unless otherwise shown on the drawings, required by permit, or approved in writing by the Engineer.

C. Stockpile excavated material on site. Any material not utilized for construction purposes may be spread onsite or removed from the site as designated by the Engineer.

3.5 FINISH GRADING

A. Before Finish Grading:
   1. Verify building and trench backfilling have been inspected.
   2. Verify subgrade has been contoured and compacted.

B. Remove debris, roots, branches, stones, in excess of 1/2 inch in size. Remove soil contaminated with petroleum products.

C. In areas where vehicles or equipment have compacted soil, scarify surface to depth of 3 inches.

D. Fine grade topsoil to eliminate uneven areas and low spots. Maintain profiles and contour of subgrade.

E. Maintain stability of topsoil during inclement weather. Replace topsoil in areas where surface water has eroded thickness below specifications.

3.6 TOLERANCES

A. Top Surface of Subgrade: Plus or minus 0.10 foot (1-3/16 inches) from required elevation.

B. Top Surface of Finish Grade: Plus or minus 0.04 foot (1/2 inch).

3.7 REPAIR AND RESTORATION

A. Existing Facilities, Utilities, and Site Features to Remain: If damaged due to this work, repair or replace to original condition.

B. Other Existing Vegetation to Remain: If damaged due to this work, replace with vegetation of equivalent species and size.

3.8 FIELD QUALITY CONTROL

A. A certified soils testing laboratory may be sourced to perform baseline Modified Proctor density tests in accordance with Cal 216 or latest revision:
   1. Tests may be performed at locations approved by the Engineer.
   2. Test results from tests prior to construction will be made available to the contractor.
   3. Testing is at the Owner’s expense.

B. Compaction testing will be determined at the Engineer's discretion. See Section 31 23 23: Fill.

C. If work does not meet specified requirements, remove, replace, and retest. All re-testing is at the contractor’s expense. Compaction tests shall be used as the basis for determination of acceptability of work performed under this contract.

3.9 CLEANING

A. Remove unused stockpiled topsoil. Grade stockpile area to prevent standing water.

B. Leave site clean and raked, ready to receive landscaping.

3.10 PROTECTION OF FINISHED WORK

A. If vehicular traffic has altered finished work, reshape and re-compact.

END OF SECTION 31 22 00

SECTION 31 23 23 FILL

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Filling, backfilling, and compacting for building volume below grade and paving.
   2. Backfilling and compacting for utilities outside the building to utility main connections.

B. Related Sections:
   1. Section 31 22 00: Grading.

1.3 DEFINITIONS

A. Finish Grade Elevations: Indicated on drawings.

1.4 SUBMITTALS

A. See Section 01 33 00: Submittal Procedures.

1.5 DELIVERY, STORAGE, AND HANDLING

A. When necessary, store materials on site in advance of need.

PART 2 PRODUCTS

2.1 FILL MATERIALS

A. Fill and Backfill material shall comply with the City of Westminster Standards and Specifications and the Geotechnical Report

2.2 SOURCE QUALITY CONTROL

A. See Section 01 40 00: Quality Requirements for general requirements for testing and analysis of soil material.

B. If tests indicate materials do not meet specified requirements, change material and retest.

PART 3 EXECUTION

3.1 EXAMINATION

A. Identify required lines, levels, contours, and datum locations.

B. Verify areas to be filled are not compromised with surface or ground water.

3.2 PREPARATION

A. Scarify and proof roll subgrade surface to a depth of 6 inches to identify soft spots.

B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.

C. Compact subgrade to density equal to or greater than requirements for subsequent fill material.

D. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

3.3 TOLERANCES

A. Top Surface of General Filling: Plus or minus 1 inch from required elevations.

B. Top Surface of Filling Under Paved Areas: Plus or minus 1 inch from required elevations.

END OF SECTION 31 23 23

SECTION 32 12 16 ASPHALT PAVING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. The Contractor shall furnish all tools, equipment, materials, and supplies and shall perform all labor required to complete the work as indicated in the Contract Documents and specified herein.

B. The following types of pavement shall be covered in this Section:
   1. Paving for utility trenching, parking lots, playgrounds, areas between buildings, adjacent to planting and turf areas, and as indicated on Construction Documents.

C. Related Sections:
   1. Section 31 22 00: Grading.
   2. Section 32 12 36: Seal Coats.
   3. Section 32 17 23: Pavement Markings.

1.3 SUBMITTALS

A. Mix Designs: The Contractor shall formulate a job-mix formula using the Hveem method in accordance with Standard Specifications Section 203-6.2 and submit it to the Engineer for approval. The resultant mixture shall have Hveem properties conforming to Standard Specifications Section 203-6.4.3.

B. Samples:
   1. Prior to the delivery of specified aggregate to the site, the Contractor shall submit samples of the material for the Inspector’s acceptance in accordance with Standard Specifications Section 4-1.4. Samples shall be typical of materials to be furnished from the proposed source and in conformance with the specified requirements.
   2. Aggregate base gradation and quality certifications shall be dated within 30 days of the submittal.

C. Certificates:
   1. Twenty days prior to the delivery of aggregates, asphalt materials, and paving mixes to the project site, the Contractor shall submit to the Engineer certificates and test results of compliance of such materials with these specifications.
   2. Submit certificates of compliance from the supplier for bituminous materials for paint binder, asphaltic concrete, and seal coat.
   3. Submit weigh master's certificates or certified delivery tickets for each truck load of asphaltic material delivered to the project site.
   4. Upon completion of the weed control treatment, and as a condition for final acceptance, furnish a written certificate stating the brand name of the sterilant and the manufacturer, and that the sterilant used had at least the minimum required concentration, and that the rate and method of application complied in every respect with the conditions and standards contained herein.

1.4 QUALITY ASSURANCE

A. The work provided herein shall conform to and be in accordance with the Standard Specifications for Public Works Construction (GREENBOOK), 2015 Edition, adopted by the Southern California Chapter, American Public Works Association; herein referred to as the "Standard Specifications".

B. The Owner's inspector shall test the temperature of each batch of asphaltic concrete prior to placement. At the time of delivery to the work site, the temperature of mixture shall not be lower than 260 degrees F or higher than 320 degrees F, the lower limit to be approached in warm weather and the higher in cold weather. If asphaltic concrete temperature is not within these tolerances the affected batch shall be rejected. Any and all costs due to the rejected asphaltic concrete shall be the responsibility of the paving contractor.

C. Asphaltic Concrete Producers Qualifications: Use only materials furnished by a bulk asphaltic concrete producer regularly engaged in production of hot mix, hot laid bituminous concrete.

D. Applicator Qualifications: Paving machine and roller operators shall be fully trained and experienced in the installation of asphaltic concrete paving on projects of similar size and complexity.

E. Regulatory Requirements: The quantity of volatile organic compounds (V.O.C.) used in weed killer, seal coat, primer and other materials shall not exceed the limits permitted under the current regulations of the local authorities having jurisdiction.

1.5 ESTABLISHMENT OF GRADES

A. The Contractor's Surveyor will set grade stakes. The Surveyor shall be a California registered land surveyor or licensed Civil Engineer. The Surveyor shall be hired and paid by the Contractor, and shall be subject to the approval of the Owner. Contractor shall notify the Owner at least 48 hours before staking is to be started. The Owner will determine if work is ready for staking.

B. All work shall conform to the lines, elevations, and grades shown on the Construction Plans. Three consecutive points set on the same slope shall be used together so that any variation from a straight grade can be detected. Any such variation shall be reported to the Engineer. In the absence of such report, the Contractor shall be responsible for any error in the grade of the finished work.

C. Protect and maintain stakes in place until their removal is approved by the Owner. Grade or location stakes lost or disturbed by Contractor, shall be reset by the Surveyor at the expense of Contractor.

D. Areas having drainage gradients of 2 percent or more shall have elevation stakes, set with instrument, at grid intervals of 25 feet. Intermediate stakes may be set by using a tightly-drawn string line over the tops of adjacent stakes. Grade stakes must be set at all grade breaks, grade changes, etc.

E. Areas having drainage gradients of less than 2 percent shall have elevation stakes, set with instrument, at 10 foot intervals. Grade stakes must be set at all grade breaks, grade changes, etc.

1.6 ENVIRONMENTAL LIMITATIONS

A. Do not apply asphalt materials if substrate is wet or excessively damp or if the following conditions are not met:

1. Tack Coats: Minimum surface temperature of 60 deg F.
2. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
3. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.

1.7 PAVEMENT-MARKING PAINT

A. Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials, 50 deg F for water-based materials, and not exceeding 95 deg F.

1.8 WARRANTY

A. The contractor shall provide a manufacturer's warranty against "aligatoring" and settlement.

PART 2 PRODUCTS

2.1 MATERIALS

A. Base Course Material: Crushed aggregate base material shall consist of materials that meet the provisions of Specifications Section 31 22 00: Grading.

B. Asphalt Surfacing Materials - Furnish asphalt surfacing meeting the following requirement, furnished from a commercial asphalt central mixing plant:
   1. Paint Binder/Tack Coat: Asphalt emulsion shall be CSS-1 or CSS-1h and shall conform to the requirements of Standard Specifications Section 203-3 Emulsified Asphalt.
   2. Asphalt Concrete Composition & Grading:
      a. Asphalt concrete shall conform to Standard Specification Section 203-6.4.3, Type C2, with asphalt content of 4.6% to 6.0%.
      b. Asphalt performance grade shall be PG-64-10.
      c. At least two courses of asphalt shall be laid when Type C2 asphalt pavement is greater than 3 inches. The surface course shall be a minimum thickness of one inch (1") and a maximum of two inches (2").
      d. Rubberized asphalt paving is not allowed.

2.2 WEED CONTROL

A. The soils sterilant shall be in accordance with current EPA acceptable standard and the California Department of Pesticide Regulations for soils sterilant. Sterilant shall be selected as appropriate for the environment in which is it to be placed. Contractor shall be licensed with the State of California to apply sterilant. Sterilant shall be commercial grade for commercial application. Payment for soil sterilization will include full compensation for application and all materials and incidental work required.

B. Apply Dow Elanco Spike 80DF, or approved equal, to subgrade at all locations receiving asphalt pavement. Spike 80DF weed control should be applied at the rate of seven pounds per acre. If another manufacturer is used follow their recommendations.

C. Pavement Marking Paint:
   1. Alkyd-resin type, lead and chromate free.

D. Headers and Stakes:
   1. Headers: Pressure Treated Redwood, Construction Heart Grade, size 2 x 6, unless otherwise indicated on construction drawings

2. Stakes: 2 x 4 redwood or 2 x 3 Douglas fir, Construction Grade.
3. Nails: Common, galvanized, 12d minimum.

PART 3 EXECUTION

3.1 HEADERS

A. Install headers along edge of bituminous surfacing abutting turf, earth, or planting area, unless indicated otherwise.

B. Install headers so the bottom surface has continuous bearing on solid grade. Where excavation for headers is undercut, thoroughly tamp soil under the header. Compact backfill on both sides of header to the density of adjacent undisturbed earth.

C. Fasten headers in place with redwood or Douglas fir stakes of length necessary to extend into solid grade a minimum of 12 inches. Stakes shall be of sound material, neatly pointed, driven vertically, and securely nailed to headers. Space stakes, not to exceed 4 feet on centers with top of stakes set one inch below top of header. Provide a minimum of 2-12d galvanized common nails through each stake.

D. Remove existing headers where new surfacing is installed adjacent to existing surfacing.

E. Install temporary headers at transverse joints of paving where continuous paving operations are not maintained.

F. Provide additional stakes and anchorage as required to fasten headers in place

3.2 SUBGRADE PREPARATION

A. Subgrade Preparation:
1. It is required that the native soil, and/or imported fill material, below the new aggregate base, be over excavated to the recommended minimum depth of 24” (inches). Refer to section 13.12 of the soils report for recompaction requirements. The extent and depths of removal should be evaluated by Geotechnical representative in the field based on the materials exposed. Additional removals may be recommended if loose or soft soils are exposed during grading.
2. Prior to placement of engineered fill, the subgrade shall be scarified to a depth of at least 8 inches, moisture conditioned and recompacted to a minimum 90% relative density.

B. The above subgrade preparation recommendations are based on the assumption that soils encountered during field exploration are representative of soils throughout the site. However, there can be unforeseen and unanticipated variations in soils between points of subsurface exploration. For this reason, the actual subgrade preparation will have to be determined on the basis of in-grading observations and testing performed by representatives of the project geotechnical consultant.

C. A California Licensed Surveyor (LS) must provide grade stakes and elevations for the Geotechnical Engineer to verify that the over-excavation depths, shown on the construction drawings for asphalt concrete pavement structural sections, have been achieved prior to re-compaction.

D. Subgrade tolerances: Subgrade for pavement shall not vary more than 0.02’ from the specified grade and cross section established by the Engineer. Subgrade for subbase or base material shall not vary more than 0.04’ from the specified grade and cross section.

Variations within the above specified tolerances shall be compensating so that the average grade and cross section specified are met.

E. Correct irregularities by dressing down or filling as may be required, to bring areas to true subgrade elevations.

F. Where filling is required, scarify the subgrade to bond the new material to the in place material; use additional material as required, subject to the approval of the Architect, and provided by the Contractor.

G. Remove excess material from the site to a legal disposal area.

3.3 APPLICATION GENERAL

A. Finish elevations, extent of asphalt paving and locations of type of asphalt and class of base shall be as indicated and specified herein and on the Construction Documents. Bring subgrade elevations sufficiently below the finish elevations of the paving so as to accommodate the thickness of paving and base.

3.4 STERILANT APPLICATION

A. Place herbicide below pavement crushed aggregate base course. Meet the applicable environmental control requirements. Apply as directed by the manufacturer's printed instructions just before application of the base course. Sterilant shall not be applied within two feet of planting areas.

3.5 APPLICATION OF BASE COURSE

A. Install base course material, encompassing spreading and compacting, in accordance with the S.S.P.W.C. Section 301-2, Untreated Base.

B. Aggregate bases material shall be installed in layers not exceeding 3-inches and compacted to a minimum of 95% relative density.

C. After preparing the subgrade as specified in 3.5.A, all traffic on the subgrade shall be avoided. Should it be necessary to haul over the prepared subgrade, the Contractor shall drag and roll the traveled way as frequently as may be necessary to remove ruts, cuts, and breaks in the surface. All cuts, ruts, and breaks in the surface of the subgrade that are not removed by the above operations shall be raked and hand tamped. All equipment used for transporting materials over the prepared subgrade shall be equipped with pneumatic tires.

D. Continued use of sections of prepared subgrade for hauling, so as to cut up or deform it from the true cross-section, will not be permitted. The Contractor shall protect the prepared subgrade from all traffic.

E. Maintain the surface in its finished condition until the succeeding layer is placed.

3.6 PLACING ASPHALT CONCRETE SURFACING

A. Asphalt binder (tack coat) shall be applied to all existing pavement surfaces to be overlaid and/or joined per section 302-5.4 of the Standard Specifications. Asphalt binder (tack coat) shall be applied to existing surfaces to be surfaced and between layers of asphalt concrete, except when eliminated by the Engineer. A layer of asphalt binder (tack coat) shall be applied to all vertical-cut faces and between subsequent AC lifts.

B. Asphalt Concrete Pavement:

1. All work shall be in accordance with Section 302-5 of the Standard Specifications, except as noted herein. Asphalt concrete work shall include full-depth patching and variable thick asphalt concrete transition areas. The Contractor shall, on a daily basis, provide the Inspector with copies of certificates of weight for all materials delivered to the job site and/or incorporated in the work. At no time shall the coarse aggregate that has segregated from the mix be scattered across the paved mat.
2. Asphalt concrete shall not be placed on any surface, which contains ponded water or excessive moisture in the opinion of the Engineer. If paving operations are in progress and rain or fog forces a shutdown, loaded trucks in transit shall return to the plant, and no compensation will be allowed therefore. The Contractor shall furnish and use canvas tarpaulins to cover all loads of asphalt from the time that the mixture is loaded until it is discharged from the delivery vehicle, unless otherwise directed in writing by the Engineer
3. The Inspector will examine the base before the paving has begun. The Contractor will correct any deficiencies before the paving is started.
4. Asphalt concrete of the class indicated in Section 2.B.2 shall be laid in courses conforming to S.S.P.W.C. Table 302-5.5(A) unless otherwise stated herein.
5. At least two courses shall be laid when Type C2 asphalt pavement is greater than 3 inches. The surface course shall be a minimum thickness of one inch (1") and a maximum of two inches (2").
6. Successive courses may be laid upon previously laid courses as soon as the previous course has cooled sufficiently to show no perceivable displacement under equipment or loaded material delivery trucks and a tack coat has been applied.
7. Wherever AC pavement does not terminate against a curb, gutter, or another pavement, the Contractor shall provide and install a redwood or pressure treated Douglas fir header at the line of termination.
8. Pavement at all longitudinal joints shall have a Field Density of 95%, as described in 302-5.6.2 of the Standard Specifications. When the test results of the field cores are less than 95% Relative Compaction, the Contractor shall remove a 1 foot wide section on each side of the longitudinal joint. The Contractor shall replace the removed pavement with an asphalt mix that meets the job specification at no additional cost to the Owner.
9. Pavement tolerances: within 1/8-inch of design thickness and 1/8-inch from design elevation.

3.7 FLOOD TESTING

A. Flood Test: Before acceptance, all pavements shall be water tested to ensure proper drainage as directed by the Inspector. The Contractor shall provide water for this purpose. The flooding shall be done by water tank truck. Depressions where the water ponds to a depth of more than 1/8-inch shall be filled or the slope corrected to provide proper drainage. The edges of the fill shall be feathered and smoothed so that the joint between the fill and the original surface is invisible. No standing water shall remain after 30 minutes on a 70 degree F (or warmer) day.

3.8 SEAL COAT

A. Allow new asphalt pavement to cure 30 days before application of seal coat. See Project Specification Section 32 12 36: Seal Coats.

3.9 FIELD QUALITY CONTROL

A. Thickness: Tolerances for asphalt pavement thickness shall be ¼ inch, plus or minus.

B. All paving shall drain properly before being accepted. Upon completion, the pavement shall

be true to grade and cross section. The asphalt substrate, shall not vary from the planned cross slope by more than +- 0.1. When a 10 foot straightedge is laid on the finished surface of the asphalt, the surface shall not vary from the edge of the straightedge more than 1/8 inch, except at grade breaks. Where paving does not meet these tolerances, the paving material shall be repaired by a method determined by the Owner. Repairs shall not be made to pavement surface by feather-edging at the join lines. All expenses for pavement repair up shall be borne by the Contractor at NO cost to the Owner.

C. Corrective Measures: It is the Contractor's responsibility to determine if the planarity, cross slopes, and general specifications have been met. If all of the conditions have been met the Contractor must notify the Owner in writing of the acceptance of the asphalt paving.

3.10 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.11 CLEAN UP

A. Clean all debris and unused materials from the paving operation. Clean all surfaces that have been spattered or defaced as a result of the paving operation. Asphalt or asphalt stains which are noticeable upon surfaces of concrete, or materials which will be exposed to view, shall be promptly and completely removed. Cleaning shall be done in a manner that will not result in any discharge of contaminated materials into any catch basin. All expenses for cleanup shall be borne by the Contractor at NO cost to the Owner.

END OF SECTION 32 12 16

SECTION 32 16 00 SITE CONCRETE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. The Section describes the requirements for providing portland cement concrete paving, including accessibility ramps, sidewalks, accessible routes of travel, vehicular travel, drain structures, sewer structures, thrust blocks and for other non-structural or non-vehicular applications.

1.2 INCLUSION OF OTHER CONTRACT DOCUMENTS

A. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01 45 00, Testing Lab Services.

B. Section 31 00 00, Earthwork.

1.4 QUALITY ASSURANCE

A. Use only new materials and products.

B. Use materials and products of one manufacturer whenever possible.

C. All materials, components, assemblies, workmanship and installation are to be observed by the Owner's Inspector of Record. Work not so inspected is subject to uncovering and replacement.

D. Sieve analysis from testing laboratories identifying rock/sand percentages within the concrete mix; or class 2 aggregate base shall have the current project name and project location identified on the report. Outdated analytical reports greater than 90 days old will not be accepted

1.5 SUBMITTALS

A. Refer to Section 13 33 00.

B. Manufacturer's Data: Submit list and complete descriptive data of all products proposed for use. Include manufacturer's specifications, published warranty or guarantee, installation instructions, and maintenance instructions.

C. Materials list: Submit to the Architect a complete list of all materials proposed to be used in this portion of the work. Submitted items should include but are not limited to sand, gravel, admixtures, surface treatments, coloring agents, sealers, fibers, cast-in-place accessories, forming and curing products and concrete mix designs.

D. With concrete submittal, provide documented history of mix design performance.

1.6 WARRANTY

A. Refer to General Conditions and Section 01 78 36.

1.7 REFERENCES AND STANDARDS

A. California Building Code, 2022 edition.

B. ACI Standards, ACI 211.1, ACI 318-14, ACI 302, IR-04, ACI 301-16, ACI 305R-10, ACI 306R-16, ACI 308-16.

C. ASTM C-94, Specification for Ready-Mixed Concrete.

D. Concrete Reinforcing Steel Institute (CRSI) Manual of Standard Practice (latest edition).

E. ASTM – American Society for Testing and Materials.

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver undamaged products to job in manufacturer's sealed containers and/or original bundles with tags and labels intact.

B. Store materials in protected, dry conditions off of ground and in areas so as to not interfere with the progress of the work.

C. Transport, store and handle in strict accord with the manufacturer's written recommendations.

D. Make delivery to job when notified by Contractor verifying that the job is ready to receive the work of this Section and that arrangements have been made to properly store, handle and protect such materials and work.

E. Store cement in weather tight building, permitting easy inspection and identification. Protect from dampness. Lumpy or stale cement will be rejected.

F. Aggregates: Prevent excessive segregation, or contamination with other materials or other sizes of aggregate. Use only one supply source for each aggregate stock pile.

1.9 TESTING

A. General: Refer to Section 01 40 00 – Quality Requirements.

B. Cement and Reinforcing shall be tested in accordance with CBC Section 1910A. Testing of reinforcing may be waived in accordance with Section 1910A.2 when approved by the Structural Engineer and DSA.

1.10 ADEQUACY AND INSPECTION

A. Design, erect, support, brace and maintain formwork and shoring to safely support all vertical and lateral loads that might be applied until such loads can be carried by concrete.

B. Notify Inspector, Architect and DSA at least 48 hours prior to placing of concrete.

1.11 PROTECTION

A. Finish surfaces shall be protected at all times from concrete pour. Inspect forming against such work and establish tight leak-proof seal before concrete is poured. Finish work

damaged, defaced or vandalized during the course of construction shall be replaced by contractor at contractor expense.

1.12 FIELD MEASUREMENTS

A. Make and be responsible for all field dimensions necessary for proper fitting, slopes and completion of work. Report discrepancies to Architect before proceeding.

PART 2 PRODUCTS

2.1 MATERIALS

A. Cement: Portland cement, ASTM C150, Type II, per ACI 318-14 Section 26.4.

B. Concrete Aggregates: Normal weight aggregates shall conform to ASTM C33, except as modified by this section. Combined grading shall meet limits of ASTM C33. Lightweight aggregate shall conform to ASTM C330, suitably processed, washed and screened, and shall consist of durable particles without adherent coatings.

C. Water: Clean and free from deleterious amounts of acids, alkalis, scale, or organic materials and per ACI 318-14 Section 26.4.1.3.1.

D. Fly Ash: Western Fly Ash, conforming to ASTM C618 for Class N or Class F materials (Class C is not permitted). Not more than 15% (by mass) may be substituted for portland cement.

E. Water Reducing Admixture: Admixture to improve placing, reduce water cement ratio, and ultimate shrinkage may be used. Provide WRDA 64 by Grace Construction Products or approved equal. Admixture shall conform to ASTM C494 and ACI 318-14 Section 26.4.1.4.19(a). Such admixture must receive prior approval by the Architect, Structural Engineer, and the Testing Lab, and shall be included in original design mix.

F. Air-entraining Admixture: Daravair 1000 by Grace Construction Products or approved equal. Admixture must conform to ASTM C260 and ACI 318-14, section 26.4.1.4.

G. Surface Retarder (for exposed aggregate finishes): Rugasol-S by Sika Corporation or approved equal.

H. Form Coating: Material which will leave no residue on concrete surface that will interfere with surface coating, as approved by the Architect.

I. Reinforcement Bars: New billet steel deformed bars conforming to requirements of ASTM A615 or ASTM A706; Grade 60. Dowels for installation through expansion joints or construction joints to existing sidewalks or concrete features shall be smooth or shall be sleeved on one end for slippage.

J. Wire Mesh: 6”x6” #10 W.W.F. in 5’x10’ flat sheets. 6”x6” #10 wire rolls will not be accepted.

K. Reinforcing supports: Galvanized metal chairs or spacers or metal hangers, accurately placed 3’-0” O.C.E.W. Staggered and each support securely fastened to steel reinforcement in place. Bottom bars in footings may be supported with 3” concrete blocks with embedded wire ties. Concrete supports without wire ties will not be allowed.

L. Truncated Domes: Vitrified Polymer Composite (VPC), Cast-In-Place Detectable/Tactile Warning Surface Tiles; “Armor-Tile”, “Access Tile Tactile Systems”, or approved equal.

Tiles shall comply with Americans with Disabilities Act and the California Code of Regulations (CCR) Title 24, Part 2, Chapter 11B (dome spacing shall be 2.35”). Install tiles as recommended by manufacturer. Color, federal yellow (FS 33538).

M. Curing Compound (for exterior slabs only): Burke Aqua Resin Cure by Burke by Edoco, 1100 Clear by W.R. Meadows or accepted equal. Water based membrane-forming concrete curing compound meeting ASTM C 309 and C1315.

N. Concrete Bonding Agent: Weld-Crete by Larson Products Corp., Daraweld C by Grace Construction Products or accepted equal.

O. Patching Mortar: Meadow-Crete GPS, one-component, trowel applied, polymer enhanced, shrinkage-compensated, fiber reinforced, cementitious repair mortar for horizontal, vertical and overhead applications as manufactured by W.R. Meadows or accepted equal.

P. Non-shrink Grout: Masterflow 713 Plus by Master Builders or approved equal. Premixed,non-metallic, no chlorides, non-staining and non-shrinking per CRD-C621, Corps of Engineers Specification and ASTM C 1107, Grades B and C.

Q. Aggregate Base: Class 2 AB per Caltrans specification section 26-1.02A.

R. Expansion Joint Material: Preformed 3/8" fiber material, full depth of concrete section, with bituminous binder manufactured for use as concrete expansion joint material, as accepted by the Architect.

S. Joint sealant for expansion joints: Single component silicone sealant, Type S, ASTM D5893.
1. Reference Standard: ASTM C920, Grade P, Class 25, Use T.
2. Dow Corning 890-SL (self-leveling) Silicone, or accepted equal.
3. Dow Corning 888-NS (non-sagging) Silicone, at slopes exceeding 5%. May not be used at asphalt surfaces.
4. Color: Custom color as selected by Architect.

T. Pre- Formed plastic Expansion Joint; W.R. Meadows 3/8” “Snap Cap”, Tex-Trude expansion joint cap, or an approved equal.

U. Adhesive Anchoring (Epoxy): Hilty HIT-HY 200 Safe Set, or approved equal.

2.2 CONCRETE DESIGN AND CLASS

A. Class “B”: Concrete shall have 1" max. size aggregate, shall have 3000 psi min. at 28 day strength with a maximum water to cementitious ratio no greater than 0.50. Use for exterior slabs, including walks, vehicular paved surfaces, manhole bases, poured-in-place drop inlets, curbs, valley gutters, curb & gutter and other concrete of like nature.

B. Slump Limits: Provide concrete, at point of final discharge, of proper consistency determined by Test Method ASTM C143 with a slumps of 4" plus or minus 1".

C. Mix Design: All concrete used in this work will be designed for strength in accordance with provisions of ACI 318-14 Section 26.4. Should the Contractor desire to pump concrete, a modified mix design will need to be submitted for review. Fly ash may be used in concrete to improve workability in amounts up to 15% of the total cementitious weight.

D. Air Entrainment; Per the Local Jurisdiction minimum requirements, or 3% minimum.

2.3 MIXING OF CONCRETE

A. Conform to requirements of CBC, Chapter 19A.

B. All concrete shall be mixed until there is uniform distribution of material and mass is uniform and homogenous; mixer must be discharged completely before the mixer is recharged.

C. Concrete shall be Ready-mixed Concrete: Mix and deliver in accordance with the requirements set forth in ASTM C94 and ACI 301. Batch Plant inspection may be waived in accordance with CBC Section 1705A.3.3.1, when approved by Structural Engineer and DSA.
   1. Approved Testing Laboratory shall check the first batching at the start of the work and furnish mix proportions to the Licensed Weighmaster.
   2. Licensed Weighmaster to positively identify materials as to quantity and to certify to each load by ticket.
   3. Ticket shall be transmitted to Project Inspector by truck driver with load identified thereon. Project Inspector will not accept load without load ticket identifying mix and will keep daily record of pours, identifying each truck, its load and time of receipt and will transmit two copies of record to DSA.
   4. At end of project, Weighmaster shall furnish affidavit to DSA on form satisfactory to DSA, certifying that all concrete furnished conforms in every particular and to proportions established by mix designs.
   5. Placement of concrete shall occur as rapidly as possible after batching and in a manner which will assure that the required quality of the concrete is maintained. In no case may concrete be placed more than 90 minutes from batch time.
   6. Water may be added to the mix only if neither the maximum permissible water-cement ratio nor the maximum slump is exceeded. In no case shall more than 10 gallons of water shall be added to a full 9 yard load, or 1 gal. per yard on remaining concrete within the drum providing load tag indicates at time of mixing at plant will allow for additional water.

2.4 MATERIALS TESTING

A. Materials testing of concrete and continuous batch plant inspection may be waived in accordance CBC Sections 1704A.4.4 when approved by Structural Engineer and DSA.

B. Testing of concrete shall be performed per article 3.12 of this specification.

2.5 EQUIPMENT

A. Handling and mixing of concrete: Project Inspector may order removal of any equipment which in his opinion is insufficient or in any way unsuitable.

PART 3 EXECUTION

3.1 APPROVAL OF FORMS AND REINFORCEMENTS

A. Forms and reinforcements are subject to approval by the Project Inspector, and notice of readiness to place first pour shall be given to DSA, Architect and Structural Engineer 48 hours prior to placement of concrete. Before placing concrete, clean tools, equipment and remove all debris from areas to receive concrete. Clean all reinforcing and other embedded items off all coatings oil, and mud that may impair bond with concrete.

B. All reinforcing steel and or W.W.F. shall be adequately supported by approved devices on centers close enough to prevent any sagging.

C. All reinforcing bar lap splices shall be staggered a minimum of 5 ft.

D. W.W.F. shall be lapped a minimum of 6” on each side of sheets and 12” on each end. Laps shall be wired together 2ft on center maximum spacing. End laps shall be staggered 2’-0” minimum from adjacent reinforcement.

E. Additional reinforcing steel shall be placed around all utility boxes, valve boxes, manhole frames and covers that are located within the concrete placements.
   1. The bars shall be placed so that there will be a minimum of 1 ½” clearance and a maximum of 3” clearance. The reinforcing steel shall be placed mid-depth of concrete slab.

F. At all right angles or intersections of concrete walks, additional 2’x2’ #5, 90 degree bars shall be added at all inside corners for additional crack control. The bars shall be placed 2” from concrete forms and supports at mid-depth of slab.

3.2 PROTECTION

A. Protect work and materials of this Section prior to and during installation, and protect the installed work and materials of other trades.

B. In the event of damage, make all repairs and replacements necessary to the approval of the Architect at no additional cost to the Owner.

C. Sub-Grade in vehicular concrete paved areas: Subgrade shall be clean, shaped and compact to hard surface free from elevations or depressions exceeding 0.05’ in 10' from true plan. Compact per Section 31 00 00. Compaction and moisture content shall be verified immediately prior to placement of concrete. Proof roll subbase in presence of geotechnical engineer prior to placement of aggregate base.

3.3 CLEANING

A. Reinforcement and all other embedded items at time of placing concrete to be free of rust, dirt oil or any other coatings that would impair bond to concrete.

B. Remove all wood chips, sawdust, dirt, loose concrete and other debris just before concrete is to be poured. Use compressed air for inaccessible areas. Remove all standing water from excavations.

3.4 FORMING

A. Form material shall be straight, true, sound and able to withstand deformation due to loading and effects of moist curing. Materials which have warped or delaminated, or require more than minor patching of contact surfaces, shall not be reused.

B. Build forms to shapes, lines, grades and dimensions indicated. Construct form work to maintain tolerances required by ACI 301. Forms shall be substantial, tight to prevent leakage of concrete, and properly braced and tied together to maintain position and shape. Butt joints tightly and locate on solid backing. Chamfer corners where indicated. Form bevels, grooves and recesses to neat, straight lines. Construct forms for easy removal without hammering, wedging or prying against concrete.

C. Space clamps, ties, hangers and other form accessories so that working capacities are not exceeded by loads imposed from concrete or concreting operations.

D. Build openings into vertical forms at regular intervals if necessary to facilitate concrete placement, and at bottoms of forms to permit cleaning and inspection.

E. Build in securely braced temporary bulkheads, keyed as required, at planned locations of construction joints.

F. Slope tie-wires downward to outside of wall.

G. Brace, anchor and support all cast-in items to prevent displacement or distortion.

H. During and immediately after concrete placing, tighten forms, posts and shores. Readjust to maintain grades, levels and camber.

I. Concrete paving, Curbs, Curb and Gutters, Ramps:
   1. Expansion Joints: Install at locations indicated, and so that maximum distance between joints is 20' for exterior concrete unless otherwise shown. Expansion joint material shall be full depth of concrete section. Recess for backer rod and sealant where required. Expansion joints shall not exceed ¼ inch depth measured from finish surface to top of felt or sealant, and ½ inch width.
   2. Curbs, Valley Gutter, and Curb & Gutter: Install expansion joints at 60' on center, except when placing adjacent to concrete walks, the expansion joints shall align with the expansion joints shown for the concrete walks. Expansion joint material shall be full depth of concrete section. Recess for backer rod and sealant will be required.
   3. Isolation Joints: 3/8" felt between walls and exterior slabs or walks so that paved areas are isolated from all vertical features, unless specifically noted otherwise on plans.
   4. Exterior Concrete Paving: Install expansion joints at 20' on center maximum, both directions, unless shown otherwise on plans.
   5. Ramps; whether shown or not all ramps shall have control joints and expansion joints.
      a. Control joints on ramps shall be aligned and be placed in between with the vertical posts for the handrails. The curbs, if required shall have control joints that align with the handrail posts.
      b. Expansion joints shall be placed at the upper, intermediate, and bottom landings.

3.5 FORM COATING

A. Before placement of reinforcing steel, coat faces of all forms to prevent absorption of moisture from concrete and to facilitate removal of forms. Apply specified material in conformance with manufacturer's written directions.

B. Before re-using form material, inspect, clean thoroughly and recoat.

C. Seal all cut edges.

3.6 INSTALLATION

A. General: Reinforcement shall be accurately placed at locations indicated on the drawings within required tolerances and providing required clearances. Reinforcement shall be secured prior to placement of concrete such that tolerances and clearances are maintained. Coverage shall be in accordance with Section 1907A.7 of the CBC. Keep a person on the job to maintain position of reinforcing as concrete is placed. Reinforcement must be in place before concreting is begun. Install dowels as shown on drawings. Give notice whenever pipes, conduits, sleeves, and other construction interferes with placement; obtain method of procedure to resolve interferences. All expansion and construction joints in concrete shall have dowels of size and spacing as shown, or as approved by Architect.

B. Placing Tolerances:
   1. Per ACI 301 or CRSI/WCRSI Recommended Practice for Placing Reinforcing Bars, unless otherwise shown.

2. Clear distance between parallel bars in a layer shall be no less than 1", the maximum bar diameter not 1 ½ times the maximum size of coarse aggregate.

C. Splices:
1. General: Unless otherwise shown on drawings, splice top reinforcing at midspan between supports, splice bottom reinforcing at supports and stagger splices at adjacent splices 5 foot minimum. Bar laps shall be wired together. Reinforcing steel laps shall be as follows:
   a. Lap splices in concrete: Lap splice lengths shall not be less than 62 bar diameter for No. 5 bar, 56" minimum for No. 6 bars. No. 4 bar shall have a minimum of 24" splice. 93 bar diameters for No. 7 bars and larger.
   b. All splices shall be staggered at 5 feet minimum.

3.7 INSPECTION

A. Approval of reinforcing steel, after installation, must be received from Inspector. Architect, Structural Engineer and DSA must be notified 48 hrs. in advance of beginning of concrete placement operations.

B. Slope of concrete forms and finish condition shall be checked with a two foot (2') digital level.

3.8 PLACING OF CONCRETE

A. Adjacent finish surfaces shall be protected at all times during the concrete pour and finishing. Verify that all formwork is tight and leak-proof before concrete is poured. Finish work defaced during the concrete pour and finishing shall be replaced at no extra cost to the owner.

B. Transport concrete from mixer to place of final deposit as rapidly as practicable by methods which will prevent separation or loss of ingredients. Deposit as close as practicable in final position to avoid re-handling or flowing. Partially hardened concrete must not be deposited in work. Concrete shall not be wheeled directly on top of reinforcing steel.

C. Placing: Once started, continue concrete pour continuously until section is complete between predetermined construction joints. Prevent splashing of concrete onto adjacent forms or reinforcement and remove such accumulation of hardened or partially hardened concrete from forms or reinforcement before work proceeds in that area. Free fall of concrete shall not to exceed 4'-0" in height. If necessary, provide lower openings in forms to inject concrete and to reduce fall height.

D. Remove form spreaders as placing of concrete progresses.

E. Place footings as monolithic and in one continuous pour.

F. Keep excavations free of standing water, but moisture condition sub-grade before concrete placement.

G. Compacting: All concrete shall be compacted by mechanical vibrators. Concrete shall be thoroughly worked around reinforcement and embedded fixtures and into corners of forms. Vibrating shall not be applied to concrete which has already begun to initially set nor shall it be continued so long as to cause segregation of materials.

H. Concrete Flatwork:
1. All flatwork shall be formed and finished to required line and grades. Flatwork shall be

true and flat with a maximum tolerance of 1/8" in 10’ for flatness. Flatwork which is not flat and are outside of the maximum specified tolerances shall be made level by the Contractor at no additional expense to the Owner.

2. Thoroughly water and soak the flatwork subgrade as required to achieve required moisture content prior to the concrete pour. Provide damming as required to keep water within the formed area and to allow for proper saturation of the subgrade.
3. Concrete vibrator shall be used to assist concrete placement. Contractor shall have spare concrete vibrator on site during concrete placement.
4. Thoroughly water and soak the exterior slabs, curbs, curb and gutters, footing subgrades with multiple daily waterings for at least three (3) days or as required to achieve required moisture content prior to the concrete pour in order to place the subgrade soils in full expansion. Provide damming as required to keep standing water within the formed area and to allow for proper saturation and full expansion of the subgrade soils. Remove any standing water before concrete placement.

I. Placing in hot weather: Comply with ACI 305R-10. Concrete shall not exceed 85 degrees F at time of placement. Concrete shall be delivered, placed and finished in a sufficiently short period of time to avoid surface dry checking. Concrete shall be kept wet continuously after tempering until implementation of curing compound procedure in accordance with this specification.

J. Placing in cold weather: Comply with ACI 306R-16. Protect from frost or freezing. No antifreeze admixtures are permitted. When deposited concrete during freezing or near-freezing weather, mix shall have temperature of at least 50 degrees F but not more than 90 degrees F. Concrete shall be maintained at temperature of at least 50 degrees F for not less than 72 hours after placing or until it has thoroughly hardened. Provide necessary thermal coverings for any flat work exposed to freezing temperatures.

K. Horizontal construction joint: Keep exposed concrete face of construction joints continuously moist from time of initial set until placing of concrete; thoroughly clean contact surface by chipping entire surface not earlier than 5 days after initial pour to expose clean hard aggregate solidly embedded, or by approved method that will assure equal bond, such as green cutting. If contact surface becomes contaminated with soil, sawdust or other foreign matter, clean entire surface and re-chip entire surface to assure proper adhesion.

3.9 CONCRETE FINISHES

A. Concrete Slab Finishing: Finish slab as required by ACI 302.1R. Use manual screeds, vibrating screeds to place concrete level and smooth. Use “jitterbugs” or other special tools designed for the purpose of forcing the course aggregate below the surface leaving a thick layer of mortar 1 inch in thickness. Surface shall be free from trowel marks, depressions, ridges or other blemishes. Tolerance for flatness shall be 1/8" in 10'. Provide final finish as follows:

1. Flatwork, medium broom finish: Typical finish to be used at all exterior walks and stairs.
2. Ramps, heavy broom finish: Concrete surfaces with slope greater than 5% including all ramps. Brooming direction shall run perpendicular to slope to form non-slip surface
3. Under no circumstances can water be added to the top surface of freshly placed concrete.

B. Curb Finishing: Steel trowel.

C. Joints and Edges: Mark-off exposed joints, where indicated, with ¼” radius x 1” deep jointer or edging tool. Joints to be clean, cut straight, parallel or square with respect to concrete walk edge. Tool all edges of exposed expansion and contraction joints, walk edges, and wherever concrete walk adjoins other material or vertical surfaces.

1. The expansion joints shall be full depth as shown in the plan details. Failure to do so will result in non-compliance and shall be immediately machine cut by the contractor at his expense.

D. Exposed Concrete Surface Finishing (not including top surface of flatwork): Remove fins and rough spots immediately following removal of forms from concrete which is to be left exposed. Damaged and irregular surfaces and holes left by form clamps and sleeves shall be patched with grout. Tie wires are to be removed to below exposed surface and holes pointed up with neat cement paste similar to procedure noted under "Patching" below. Removal of tie wires shall extend to distance of 2" below established grade lines. Ends of tie wires shall be cut off flush at all other, unexposed locations. Care shall be taken to match adjacent finishes of exposed concrete surface. After patching, all concrete that is to remain exposed, shall be sacked with a grout mixture of 1-part cement, 1 1/2- parts fine sand and sufficient water to produce a consistency of thick paint. After first wetting the concrete surface, apply mixture with a brush and immediately float entire surface vigorously using a wood float. Keep damp during periods of hot weather. When set, excess grout shall be scraped from wall with edge of steel trowel, allowed to set for a time, then wiped or rubbed with dry burlap. Entire finishing operation of any area shall be completed on the same day. This treatment shall be carried to 4" below grade, and all patching and sacking shall be done immediately upon removal of the forms.

E. Stair Treads and Risers: Tool exterior stair tread nosing per ADA requirements and as detailed. Paint or stain tooled area at every stair tread nosing or as detailed. Stair tread nosing shall contain no pockets, voids or spalls. Patching is not allowed. Damaged nosing shall be replaced.

3.10 CURING

A. Cured Concrete in Forms: Keep forms and top on concrete between forms continuously wet until removal of forms, 7 days minimum. Maintain exposed concrete in a continuous wet condition for 14 days following removal of forms.

B. Flatwork/Variable Height Curbs, Curb and gutter, Valley Gutter: Cure utilizing Curing Compound. If applicable, the Contractor shall verify that the approved Curing Compound is compatible with the approved colorant system. Upon completion of job, wash clean per manufacturer's recommendations.
   1. Curing compound shall be applied in a wet puddling application. Spotty applications shall be reason for rejection and possibly concrete removal and replacement at the contractor's expense with no compensation from the owner.

C. No Curing Compound shall be applied to areas scheduled to receive resilient track surface including, curbs, ramps, run ways, etc.

3.11 DEFECTIVE CONCRETE

A. Determination of defective concrete shall be made by the Architect or Engineer. His opinion shall be final in identifying areas to be replaced, repaired or patched.

B. The Owner reserves the right to survey the flatwork, if it is determined to be outside of the maximum tolerance for flatness. If the flatwork is found to be out of tolerance, then the Contractor will be required to replace concrete. The Contractor will be responsible for reimbursing the Owner for any surveying costs incurred. Determination of flatwork flatness, surveying and any remedial work must be completed far enough in advance so that the project schedule is maintained, delays are avoided and the new flatwork or flatwork repairs are properly cured.

C. As directed by Architect, cut out and replace defective concrete. All defective concrete shall be removed from the site. No patching is to be done until surfaces have been examined by Architect and permission to begin patching has been provided.

D. Permission to patch any area shall not be considered waiver of right, by the Owner, to require removal of defective work, if patching does not, in opinion of Architect, satisfactorily restore quality and appearance of surface.

E. Defective concrete is:
1. Concrete that does not match the approved mix design for the given installation type.
2. Concrete not meeting specified 28-day strength.
3. Concrete which contains rock pockets, voids, spalls, transverse cracks, exposed reinforcing, or other such defects which adversely affect strength, durability or appearance.
4. Concrete which is incorrectly formed, out of alignment or not plumb or level.
5. Concrete containing embedded wood or debris.
6. Concrete having large or excessive patched voids which were not completed under Architect's direction.
7. Concrete not containing required embedded items.
8. Excessive Shrinkage, Traverse cracking, Crazing, Curling; or Defective Finish. Remove and replace if repair to an acceptable condition is not feasible.
9. Concrete that is unsuitable for placement or has set in truck drum for longer than 90 minutes from the time it was batched.
10. Expansion joint felt that is not isolating the full depth of the concrete section, and recessed as required for backer rod and sealant where required.
11. Concrete that is excessively wet or excessively dry and will not meet the minimum or maximum slump required per mix design.
12. Finished concrete with oil stains from equipment use, and or rust spots that cannot be removed.
13. Control joints (weakened planed joints) that do not meet the required minimum depth shown on the drawings.

~~F.~~ Patching: Install specified Patching Mortar per manufacturer’s recommendations. REPAIRS TO DEFECTIVE CONCRETE WHICH AFFECT THE STRENGTH OF ANY STRUCTURAL CONCRETE MEMBER OR COMPONENT ARE SUBJECT TO APPROVAL BY THE ARCHITECT AND DSA.

3.12 CONCRETE TESTING

A. Comply with CBC Section 1903A, 1905A.1.16, 1910A and 1705A.3 and as specified in B. below. Costs of tests will be borne by the Owner.

B. Four identical cylinder samples for strength tests of each class of concrete placed each day shall be taken not less than once a day, or not less than once for each 50 cubic yards of concrete, or not less than once for each 2,000 square feet of surface area for slabs or walls. In addition, samples for strength tests for each class of concrete shall be taken for seven-day tests at the beginning of the concrete work or whenever the mix or aggregate is changed.

C. Strength tests will be conducted by the Testing Lab on one cylinder at seven (7) days and two cylinders at twenty-eight (28) days. The fourth remaining cylinder will be available for testing at fifty-six (56) days if the 28-day cylinder test results do not meet the required design strength.

D. On a given project, if the total volume of concrete is such that the frequency of testing required by paragraph B. above would provide less than five strength tests for a given class

of concrete, tests shall be made from at least five randomly selected batches or from each batch if fewer than five batches are used.

E. Cost of retests and coring due to low strength or defective concrete will be paid by Owner and back-charged to the Contractor.

F. Each truck shall be tested for slump before concrete is placed.

3.13 REMOVAL OF FORMS

A. Remove without damage to concrete surfaces.

B. Sequence and timing of form removal shall insure complete safety of concrete structure.

C. Forms shall remain in place for not less than the following periods of time. These periods represent cumulative number of days during which temperature of air in contact with concrete is 60 degrees F and above.
1. Vertical forms of foundations, walls and all other forms not covered below: 5 days.
2. Slab edge screeds or forms: 7 days.
3. Concrete columns and beam soffits: 28 days.

D. Concrete shall not be subjected to superimposed loads (structure or construction equipment) until it has attained its full design strength and not for a period of at least 21 days after placing. Concrete systems shall not be subjected to construction loads in excess of design loads.

3.14 CLEANING

A. Refer to Section 01 74 00.

B. Upon completion of work of this Section promptly remove from the working area all scraps, debris and surplus material of this Section.

C. Clean excess material from surface of all concrete walks and utility structures.

D. Power wash all concrete surfaces to remove stains, dried mud, tire marks, and rust spots.

END OF SECTION 32 16 00

SECTION 32 17 13 PARKING BUMPERS

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. Precast concrete parking bumpers and anchorage.

B. Reference Standards:
1. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement.
2. ASTM C150/C150M - Standard Specification for Portland Cement.
3. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete.
4. ASTM C330/C330M - Standard Specification for Lightweight Aggregates for Structural Concrete.

1.3 SUBMITTALS

A. See Section 01 33 00: Submittal Procedures.

PART 2 PRODUCTS

2.1 MATERIALS

A. Parking Bumpers - Precast concrete, conforming to the following:
1. Nominal Size: 7 inches high, 12 inches wide, 6 feet long. Manufactured by Granite precast or approved equal.
2. Cement: ASTM C150/C150M, Portland Type I - Normal; white color.
3. Concrete Materials: ASTM C330/C330M aggregate, water, and sand.
4. Reinforcing Steel: ASTM A615/A615M, deformed steel bars; unfinished, strength and size commensurate with precast unit design.
5. Air Entrainment Admixture: ASTM C260/C260M.
6. Concrete Mix: Minimum 4000 psi compressive strength after 28 days, air entrained to 5 to 7 percent.
7. Use rigid molds, constructed to maintain precast units, uniform in shape, size and finish. Maintain consistent quality during manufacture.
8. Embed reinforcing steel, and drill or sleeve for two dowels.
9. Cure units to develop concrete quality, and to minimize appearance blemishes such as non-uniformity, staining, or surface cracking.
10. Minor patching in plant is acceptable, providing appearance of units is not impaired.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install units without damage to shape or finish. Replace or repair damaged units.

B. Install units in alignment with adjacent work.

END OF SECTION 32 17 13