VOLUME 5 OF 6

DEFERRED MAINTENANCE
BRADLEY ELEMENTARY SCHOOL
SAN BERNARDINO CITY UNIFIED SCHOOL DISTRICT
SAN BERNARDINO, CALIFORNIA

August 25, 2009
HMC # 3137206
Bid #F08-10

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SECTION 02 41 19

SELECTIVE DEMOLITION

PART 1 - GENERAL

1.01 SECTION INCLUDES

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

B. Include Work required to demolish and remove elements of existing construction including partitions, ceilings, flooring, walls, doors, and similar elements of existing building construction, all as noted on Drawings or as required to permit installation of new construction. Refer to Cutting and Patching in Section 01 73 29.
   1. Roofing.
   2. HVAC Units.

1.02 REFERENCES

A. CBC - 2007 California Building Code
   1. CBC-19A – CBC Chapter 19A, Concrete (for DSA)
   2. CBC-33 – CBC Chapter 33, Safeguards During Construction

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

C. CFC – 2007 California Fire Code
   1. Chapter 14, Fire Safety During Construction and Demolition.

D. DSA IR 25-2 - Division of the State Architect Interpretation of Regulations

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

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

1.03 SUBMITTALS

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

PART 2 - PRODUCTS

NOT USED.

PART 3 - EXECUTION

3.01 PREPARATION

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

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

3.02 TEMPORARY MEASURES - LIFE SAFETY

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

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

C. Provide temporary, but equivalent, fire alarm, detection or suppression systems when any system is impaired by Work of this Section. Temporary systems shall be inspected and tested monthly or at other more frequent intervals as required by Owner.
   1. Impairment of fire protection systems, Section 1408.6: Impairments to any fire protection system shall be in accordance with Section 901.
   2. Systems out of Service: Per requirement of Section 901.7 through 901.7.6, California Fire Code.

D. Maintain free and unobstructed access to emergency services per Title 19, CFC 503.1; 503.1.1, 503.4; and Appendix D, 1410.1; 1412.1 and when required by Owner.

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

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

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

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

3.03 EXECUTION

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

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

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

D. Do not burn or bury materials on site.

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

3.04 SELECTIVE DEMOLITION, REPAIR AND ALTERATIONS WORK

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

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

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

D. Removal of Existing Floor Finishes:
   1. Remove existing floor covering materials in areas indicated. See Section 02 82 14 for additional requirements for removing resilient floor covering containing asbestos materials.
   2. Sandblast concrete floor surfaces (or submit alternate method to Architect for approval) to remove remaining adhesive, mortar, paint and similar materials which will affect bond of new floor coverings. International Concrete Repair Institute, ICRI Concrete Surface Profile CSP #3.
   3. Patch voids with non-shrink grout.

4. Grind high spots and fill low spots to provide an even surfaced substrate for specified new floor covering materials. Leveling materials shall be compatible with mortars and adhesives required to install finish floors. Floors shall not vary more than 1/4 inch in 10 feet as determined with straightedge.

E. Modular Materials
1. Resilient tile (VCT), ceramic tile, quarry tile, or similar materials: Remove to joint line without leaving damaged or defective units where joining new construction. After flooring removal, clean substrates to remove setting materials and adhesives.
2. Wall Removal: Remove tiles, setting materials, bonding or adhesive, metal lath, board materials to joint line or support line on stud. Verify stud to receive new construction.

F. Patching, Repairing and Finishing:
1. Concrete: Edges of existing concrete shall be kept damp for 24 hours and scrubbed with Neat Portland Cement grout just before new concrete is placed. In lieu thereof, an approved epoxy concrete adhesive may be used. Finish shall match existing adjoining Work.
2. Unless otherwise approved concrete shall match strength of existing concrete or be minimum 2,500 psi concrete for patching slabs on grade. Strength of concrete for patching structural members or deck fill shall be determined by Architect. Where cut edges are to remain exposed, finish edges with cement mortar at least 3/4 inch thick, applied over epoxy adhesive and finished to match adjoining surfaces.
3. Concrete mix for patching shall comply with Section 1905A.3 [Method B,] California Building Code.
4. Plaster: Dampen edges of existing plaster. Plaster patching shall be of type, thickness and finish to match existing Work.
5. At Removed Flooring Materials: trowel with patching compound, cement based at all areas, leave level, smooth ready to receive new flooring finish materials. At contractor's option install cement-base self-leveling underlayment at no cost to the Owner.
6. At removed casework and equipment: repair and patch surfaces with like materials and to match adjacent surfaces. Leave surfaces in acceptable condition as determined by the Architect to received new finishes.
7. Door frames: At frames locations where doors and hardware will replaced, patch holes, indentations, mortises and finish smooth to flush and match existing adjacent surfaces. Paint under Section 09 90 00.

G. Acoustical Ceilings: Existing acoustical ceiling that will be partially removed or will require patching, shall be repaired (or extended) with materials and suspension system identical to existing materials and suspension system. In no case shall components added be less in standard as defined in DSA IR 25-2.

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

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

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

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

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

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

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

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

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

3.05 SALVAGE AND DISPOSAL

A. Salvage: Offer Owner first right of refusal for the removed materials that may have residual value. Remove items designated by the Owner to be salvaged with care. Clean, wrap or crate for storage and handling, and deliver to Owner as directed.

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

END OF SECTION

SECTION 02 82 14

FLOORING REMOVAL

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Removal of designated sheet vinyl flooring materials and adhesives containing hazardous materials.

B. Temporary partitions to allow building occupancy.

1.02 REFERENCES

A. RFCI - Resilient Floor Covering Institute - Recommended Work Practices for Removal of Resilient Floor Coverings: January 1998.

B. Air Quality Management District Local Regulations.

C. NFPA 241 - National Fire Protective Association - Safeguarding Construction, Alteration and Demolition Operations.

D. CCR - California Code of Regulations, Title 8, Subchapter 4, Construction Safety Orders.

1.03 QUALITY ASSURANCE

A. Qualifications: Applicator: Company specializing in removal of flooring materials with minimum 3 years experience.

B. Regulatory Requirements
   1. Conform to AQMD Local Regulations, when hazardous or vermin infested materials are encountered. Copies of document are available at Architect's Office.
   2. Conform to Requirements of RFCI. Copies of document are available at Architect's Office.

PART 2 - PRODUCTS

NOT USED.

PART 3 - EXECUTION

3.01 PREPARATION

A. Protect existing building components that are not indicated to be altered.

B. Adequately protect staff and public from harm and accident during demolition operations by erection of proper barricades, signs, lighting, guard rails or other safety precautions. Conform to CCR and NFPA 241.

C. Protective Devices: Install substantial enclosures, weatherproof and dust-proof shields, protective covers, screens and similar devices. Erect and move when necessary to permit use of existing rooms, areas or facilities. Remove entirely when their use is no longer essential. Patch or repair areas where devices have been removed.

3.02 TEMPORARY MEASURES - LIFE SAFETY

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

B. Provide temporary but equivalent fire alarm detection or suppression systems when systems are impaired by Work of this Section. Temporary systems shall be inspected and tested monthly or at such other intervals approved by Owner.

C. Maintain free and unobstructed access to emergency services when required by Owner.

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

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

F. Require workmen to wear safety glasses.

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

3.03 EXECUTION

A. Move appliances and furniture from Work area.

B. Remove binding strips or other restrictive moldings, applied base or cove base.

C. Utilize mixture of detergent and warm water, spray applied, to abate dust particles during materials removal.

D. Wet/Dry vacuum entire surface utilizing high efficiency particulate air filter machine with disposable dust bag and metal floor tool.

E. Remove flooring in strips 4 to 8 inches wide, parallel to any wall. Make cuts through material to concrete, in straight line.

F. Systematically pull wear layer from backing by rolling on to cylinder.

G. Constantly spray detergent mixture into area of separation.

H. When resilient material is homogeneous, pull entire layer loose from substrate.

I. Do not permit felt backing to be compressed by walking on surface.

J. Immediately dispose of rolls of removed materials.

K. Remove backing and other residue remaining on slab by scrape process. Keep surfaces constantly wet to prevent dust. Avoid excess wetting or standing water.

L. Sanding or dry scraping is not permitted. Sweeping or brashing not permitted.

M. Wet/Dry vacuum entire Work area.

N. After area has dried sufficiently, vacuum entire Work area with HEPA filtration system with metal floor attachment.

3.04 MATERIALS DISPOSAL

A. Place removed materials in tightly sealed, impermeable trash bags or closed container. Include vacuumed materials.

B. Identify bags with appropriate labels and warning tags.

C. Dispose legally in appropriate disposal facility, on a daily basis as work progresses.

D. Secure and pay for all required hauling permits and dumping fees.

E. Do not utilize Owner's disposal system or any other Property Owner's disposal system.

3.05 PROTECTION OF FINISHED WORK

A. Do not permit traffic over cleaned surfaces.

END OF SECTION

SECTION 02 82 16

DISPOSAL SERVICES - LAMPS AND BALLASTS

PART 1 - GENERAL

1.01 PROJECT DESCRIPTION

A. Contractor shall provide all labor, materials, equipment, transportation, documentation and services necessary for destruction of ballasts, fluorescent lamps specified herein.

B. Owner may contract to local PCB recycling facility for 25 or less PCB Small Capacitors for recycling. Twenty Five or less PCB Small capacitors are not regulated under Title 40 Code of Federal Regulations, Section 761.60(b)(2). The said facility will issue a Certificate for proper documentation.

C. Ballasts and lamps shall be placed in Department of Transportation (DOT) approved, POPS containers, or other packaging suitable for lamp transport provided by Contractor and transported to federal or state approved processing facility.

D. PCB containing portions of ballasts shall be separated from non-PCB portions. All PCB containing material shall be disposed of by TSCA approved incinerator. Non-PCB portions shall be processed to reclaim recyclable components such as iron, steel, copper and aluminum. Landfill of any PCB waste, including capacitors, potting compound and process debris is prohibited under terms of this Contract.

E. Fluorescent lamps shall be processed to reclaim recyclable components such as glass and aluminum end caps at facility approved in accordance with 40 Code of Federal Regulations (CFR) 264.1. Phosphor powder and mercury shall be reported by federal or state approved processing facility in accordance with 40 CFR 268.42.

F. Contractor to field verify number of ballasts and lamps to be processed under terms of this Contract. Price for disposal of these ballasts and bulbs shall be included as a part of this Work.

1.02 APPLICABLE REGULATIONS

A. Applicable sections, latest editions and addenda of following government regulations, codes, industry standards and recommended practices form part of this Specification. Nothing in these Specifications is to be construed as permitting Work not conforming with these regulations.
   1. DOT Title 49, CFR, Parts 172 & 173, Subpart J.
   2. United States Environmental Protection Agency (USEPA) Title 40, CFR, Parts 261, 262, 263, 264, 761 and any other section which may be applicable to this bid.
   3. Federal Occupational Safety and Health Administration (OSHA) Title 29, CFR, Part 1910.
   4. State Occupational Safety and Health Administration.
   5. National Electric Code (NEC).
   6. All applicable county and city codes, ordinances and regulations.

B. Contractor is cautioned that he/she is responsible for ascertaining extent to which these regulations affect operations resulting from solicitation and comply therewith.

1.03 CONTRACTOR

A. Contractor shall provide written evidence that, as major part of their business, Contractor has been engaged in PCB disposal activities and/or hazardous waste disposal activities (as it may apply to fluorescent). Including processing and destruction of PCB ballasts and/or fluorescent. Related activities shall include transportation, USEPA required documentation, servicing and storage of high and low concentrations of PCB fluids and solids, and destruction of PCB carcasses. Evidence is to take form of commercial storage and incineration or alternative disposal approvals in accordance with 40 CFR 761.60, 761.65 or 761.70 and/or USEPA and/or state approvals, in accordance with RCRA standards and guidelines presented in 40 CFR 264 and 265.

B. Contractor shall provide evidence that reclaimed aluminum, copper, iron steel and/or glass are packaged to buyer's specifications and sold for purpose of re-manufacturing, Contractor shall provide copy of most recent shipping document to verify sale of reclaimed materials.

C. Contractor shall provide blank copies of following procedural documents:
   1. Invoice packet to include:
      a. Invoice
      b. Letter of material receipt
      c. Copy of inbound shipping manifest
   2. Recycling and disposal packet to include:
      a. Copy of outbound shipping manifest
      b. Certificate of recycling
      c. Certificate of disposal

D. Contractor shall supply statement of qualifications which provides details as follows:
   1. PCB ballast and lamp disposal services:
      a. Regulatory assistance and compliance
      b. Transportation capabilities
      c. Waste storage, processing and disposal capabilities
         1) Applicable facility siting and specifications (40 CFR 761.65 (b) or 264.18.
         2) Applicable facility engineering documents (SPCC, SPPP, contingency plan, etc.)
      d. Metals recycling and trade experience
      e. Personnel resources
      f. Auxiliary resources
   2. Key support capabilities
      a. Project management experience
      b. Waste analysis/materials testing
         1) On-site lab
            a) Laboratory Quality Assurance/Quality Control (QA/QC) plan
            b) State Certification
         2) Off-site lab

a) State certification
b) QA/QC plan
c) Copy of contract with facility

c. QA/QC
1) Verification of laboratory services for monitoring of resale materials
a) Verify ballast reclaimables less than 2 ppm PCB
b) Verify lamp reclaimables less than 0.2 mg/L mercury per TCLP testing

d. Occupational health and safety plan
e. Training programs
f. Waste tracking systems
g. Facility-specific information
1) Resumes of management and key personnel
2) Management organizational chart
3) Copy of permit to operate a fluorescent lamp storage and recycling facility
4) Closure plan and corresponding financial assurance
5) USEPA's approval to operate as a commercial store of PCB waste, per 40 CFR 761.65.
6) Copy of EPA's letter of approval and authorization of contractor's "alternate disposal technology" in accordance with 40 CFR 761.60(e). For purposes of recycling PCB and non-PCB ballast waste, proof of USEPA approval of recycling methods and processes is mandatory.

[*****OR*****

7) Copy of USEPA's letter of approval, and authorization for contractor to engage in incineration activities in accordance with 40 CFR 761.70.]

1.04 USE OF SUBCONTRACTORS

A. Subcontractors must meet approval of Owner, subcontractor must comply with all terms and conditions as specified herein and must have insurance coverage applicable to Work performed and described herein.

B. Any changes in subcontractor, disposal sites and incineration facilities utilized by Contractor during term of Contract must be approved by Owner prior to onset of any Work being performed by Contractor. Requests for approval must be made in writing and must be directed to Owner.

1.05 CONTAINERIZING AND MARKING

A. PCB ballasts and hazardous materials generated from project activities and cleanup operations shall be placed in USEPA specified containers. Only approved drums, conforming to USEPA specifications (DOT 17C or POPS) shall be used to contain leaking and non-leaking ballasts.

B. Containers used shall be properly sealed, marked, labeled and dated.

C. Ballasts which are visibly leaking shall be packaged separately from those ballasts which do not show visible signs of leakage.

D. Contractor shall include pricing for DOT 17C or POPS equivalent containers and/or lamp boxes of fiber drums.

1.06 TRANSPORTATION TO DESTRUCTION/SERVING FACILITIES

A. Ballasts shall be transported to TSCA permitted processing/destruction facility.

B. PCB containing capacitors, components, debris and potting compound shall be transported to a TSCA permitted incineration facility for ultimate destruction.

C. For disposal of leaking PCB ballasts and associated waste, Contractor and/or subcontractor and vehicles must be licensed for transportation and hauling of regulated materials/hazardous waste. Drivers of these vehicles shall be trained in laws, rules and regulations governing transportation of PCB materials. Vehicles must be plainly marked as specified by DOT, USEPA, State Department of Health Services, State Police and State Department of Transportation.

D. Lamps shall be transported to federally permitted TSDF or state permitted hazardous waste storage and recycling facility.

E. Recovered lamp components must be certified as non-hazardous through TCLP analysis.

F. Non-recoverable lamp components must meet 40 CFR 268.42 standards prior to disposal.

1.07 INSURANCE

A. 25 or less PCB Small Capacitors can be directed to local PCB recycling facility with minimal cost.

1.08 DOCUMENTATION

A. Contractor shall coordinate all activities under this Section with Owner's Representative. Provide information as to number of ballasts loading per ballasts on fluorescent tubes per same service. Contractor shall provide Owner with comprehensive information on all firms to be involved in PCB and lamp related Work activities as part of this Contract prior to commencement of Project. Such information shall include minimum of:

1. Name, address, telephone number, USEPA ID number, state transporter's ID number and hauler registration number of the firm(s) responsible for transportation of PCB solids and fluids, ballast containers and/or lamps which maybe delivered as hazardous waste.
2. Name, address, telephone number and USEPA ID number of firm(s) responsible for ultimate final destruction of ballasts and reclamation of recyclable components, and for firms responsible for lamp retorting.

B. Contractor shall provide Owner with comprehensive documentation of work activities upon completion of Work and prior to final payment. Such documentation shall include minimum of:

1. Type and size of containers, contents, weight or unit of measure, date transported and name, address, telephone number, USEPA ID number, and copy permit letter of processing and/or disposal facility.
2. Written certification i.e. uniform hazardous waste manifest demonstrating receipt of material at disposal/incineration facility. Such certification shall be signed by person authorized by disposal/incineration facility to accept PCB items for disposal.
3. Certificates of destruction for PCB liquids, solids and ballast carcasses, and Certificates of Retort for phosphor powder.

PART 2 - PRODUCTS

NOT USED.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor shall remove and legally dispose of lamps and ballasts indicated to be removed from project site.

END OF SECTION

SECTION 06 10 00

ROUGH CARPENTRY

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Rough carpentry.

1.02 REFERENCES

A. ASTM D4601 - Asphalt-Coated Glass Fiber Base Sheet Used in Roofing.

B. Chapters 7 and 23A, 2007 CBC.

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

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

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

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

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

H. APA - American Plywood Association Design/Construction Guide (Engineered Wood Association).

I. AQMD - Local Air Quality Management District Regulations.

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

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

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

M. ASTM E84 - Surface Burning Characteristics of Building Materials.

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

O. ICC –ES – International Code Council Evaluation Service, Inc. Legacy Reports.

1.03 SUBMITTALS

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

1.04 QUALITY ASSURANCE

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

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

C. Association performing grading and grade marking of lumber shall be approved by Architect and Division of the State Architect.

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

1.05 DELIVERY, STORAGE AND HANDLING

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

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

1.06 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.01 ROUGH CARPENTRY MATERIALS

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

4. All lumber in contact with concrete shall be pressure treated.

B. Plywood: Section 2303.1.4 CBC, Douglas Fir 1 Group Species, PS 1, APA Structural I Rated Sheathing. Bond Classification: Exterior. Thickness as indicated, span rating sized for spacing.
   1. For natural finished plywood: Panel Grade N veneer on face and B on back side.
   2. For painted finish: APA Sanded Plywood Panels, A-C Group 1, Exterior, sanded face, touch sanded back side.
   3. Thickness: Minimum 5/8 inch or as indicated on Drawings.
   4. Plywood shall be FSC certified; other sustainable forestry certifications will not be accepted.

C. Preservative (Pressure) Treated Lumber: Section 2303.1.8. Conform to AWPA Manual of Recommended Practice, kiln dry after treatment. Use preservative complying with AWPA C2 lumber and C9 plywood, latest edition. Products NOT containing arsenic or chromium. Conform to AQMD, Local Regulations.
   1. Douglas Fir Larch, used as required by Section 2303, CBC, shall conform to the following:
      a. Lumber shall be WWPA or WCLIB grade stamped.
      b. Lumber shall be No. 1 grade or better unless indicated otherwise on Drawings.

D. Nails, Spikes and Staples: Section 2304.9 CBC, Galvanized for exterior applications, high humidity locations and treated wood; plain finish for other interior locations; size and type to suit application. Comply with Table 2304.9.1. Use common nails only.

E. Bolts, Nuts, Washers, Lags, Pins and Screws: Section 2304.9 CBC, sized to suit application, galvanized for exterior locations, high humidity locations and treated wood, plain finish for other interior locations. Full diameter body bolts only per ASME B18.2.1(.2) or B18.2.6 for structural applications.

F. Fasteners: Expansion type or powder actuated type for anchorage to solid masonry or concrete. Refer to Division 01, General Requirements for acceptable types and required testing.

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

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

PART 3 - EXECUTION

3.01 FRAMING, FURRING AND STRIPPING

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

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

C. Construct and erect required headers and lintels.

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

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

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

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

H. Install 3 studs at corners.

I. Conform to Section 717, California Building Code for fire blocks and draft stops. Fire blocks and stops at 10-feet intervals and at ceiling level.

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

3.02 HORIZONTAL FRAMING

A. Bearing: 1-1/2 inch minimum on wood. Lay framing members with crown up. Members with knots at bottom not permitted.

B. Lateral Support: Use solid blocking, cross bridging or other approved means.

C. Lap joists a minimum of 3 inches when framed from opposite sides of a beam. Do not run joists continuous beyond one span unless indicated otherwise on Drawings.

D. Openings: Double joists required for trimmer and headers for openings 4 ft. or larger unless indicated otherwise on Drawings.

E. Treat ends of timber beams and posts exposed to weather by dipping in water-repellent preservative for 15 minutes.

END OF SECTION

SECTION 07 01 50

PREPARATION FOR RE-ROOFING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Removal of existing roofing and insulation covering in preparation for a new roof membrane system.

B. Removal of existing Asbestos Containing Roofing Material is not part of this Contract.

1.02 SYSTEM DESCRIPTION

A. Extent of Roof Area: Remove existing roofing gravel, perimeter flashings, base flashings, counter flashings, vent stack flashings, roofing membrane and insulation.

1.03 PRE-INSTALLATION CONFERENCE

A. Attendance Mandatory at conference required in section specifying new roofing installation.

B. Establish at pre-bid job walk, number of layers to be removed and reconfirm at pre-installation conference.

1.04 ENVIRONMENTAL REQUIREMENTS

A. Do not remove existing roofing membrane when weather conditions threaten the integrity of the building contents or intended continued occupancy.

B. Maintain continuous temporary protection during and prior to installation of new roofing system.

1.05 SCHEDULING

A. Schedule work to coincide with commencement of installation of new roofing system.

B. Remove only existing roofing materials that can be replaced with new materials as the weather will permit.

1.06 COORDINATION

A. Coordinate work with other affected mechanical and electrical work associated with roof penetrations.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Temporary Protection: Sheet polyethylene of thickness sufficient to prevent tearing or damage during use. Provide weights to retain sheeting in position.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify existing site conditions.

B. Verify that existing roof surface is clear and ready for work of this Section.

3.02 PREPARATION

A. Sweep roof surface clean of loose matter. Remove loose refuse and dispose off site legally.
   1. Free Fall Maximum: 8 ft. Provide enclosed chutes for higher fall.
   2. Provide disposals sufficiently sized to prevent debris from scattering around areas.
   3. Use support systems, intake hoppers, protective liners and durable non-breakable chutes. Max-Access Inc., Houston, TX, Chutes International, White Plains, MD or equal.
   4. Do not use Owner's disposal system.

3.03 MATERIALS REMOVAL

A. Remove metal counter flashings.

B. Scrape roofing gravel from membrane surface without causing serious damage to membrane felts.

C. Remove damaged portions of roofing membrane, perimeter base flashings, flashings around roof protrusions, pitch pans and pockets and insulation vents.

D. Cut and lay flat any membrane blisters.

E. Remove damaged insulation and fasteners, cant strips, and blocking.

F. Remove sheathing paper and underlay.

G. Repair existing wood deck surface to provide smooth working surface for new roof system.

H. Legally dispose of removed materials off-site.

3.04 TEMPORARY PROTECTION

A. Provide temporary protective sheeting over uncovered deck surfaces.

B. Turn sheeting up and over parapets and curbing. Retain sheeting in position with weights.

C. Provide for surface drainage from sheeting to existing drainage facilities.

D. Do not permit traffic over unprotected or repaired deck surface.

END OF SECTION

SECTION 07 01 52

ROOFING MEMBRANE PENETRATIONS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Coordination of roof membrane penetrations with affected trades.

B. Establishment of criteria for penetrating roof membranes either before or after installation of membranes when penetrations are required by the Work of other Sections.

C. Related Sections
1. Section 07 51 15 - Cold Process Monolithic Built-Up Roofing.
2. Section 07 62 00 - Sheet Metal Flashing and Trim.
3. Section 07 92 00 - Joint Sealers.
4. Division 23 - Heating Ventilation and Air Conditioning.
5. Division 26 - Electrical.
6. Other Sections of the Specifications requiring penetrations.

1.02 REFERENCES

A. Sheet Metal and Air Conditioning Contractors' National Association, SMACNA, "Architectural Sheet Metal Manual," Sixth Edition.

1.03 QUALITY ASSURANCE

A. Qualifications: Use only skilled workmen who are thoroughly trained and experienced in the necessary crafts.

B. Pre-installation Conference: Convene pre-installation conference under provisions of Division 01, General Requirements.

1.04 WARRANTY

A. For new Work, meet requirements of roofing and waterproofing warranties specified under applicable Division 07 Sections.

B. For existing work, Contractor shall verify if any warranty is in effect and maintain that warranty for all new penetrations. Written certification from the roofing manufacturer of the existing roofing indicating that the membrane penetrations as installed and sealed meet the or exceed the requirements to maintain the existing roofing warranty.

PART 2 - PRODUCTS

2.01 MATERIALS

A. New materials specified under other Division 07 sections.

B. Existing materials shall match existing roofing system previously installed.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine the substrates and conditions under which Work of this Section will be performed. Do not proceed until unsatisfactory conditions detrimental to timely and proper completion of the Work have been corrected.

3.02 PREPARATION

A. Protect membranes, flashing and adjoining surfaces from damage.

3.03 INSTALLATION

A. Group or cluster pipe and conduit in common penetrations wherever possible to minimize the number of penetrations through membrane.

B. Permitted clearances, except as specifically detailed:
   1. Between penetrations for single pipes: 20 inches clear.
   2. Between penetration for single pipe and toe of cant strip at curb or parapet: 18 inches clear.
   3. Between toes of cant strips at curbs or parapets: 18 inches clear.
   4. Between penetration and gravel stop perimeter: 24 inches clear.

C. Make penetrations in a manner consistent with membrane and flashing installations as follows:
   1. As detailed and specified is Section 07 62 00.
   2. Where not detailed or specified meet recommendations of Referenced Standards as follows.
      a. SMACNA Figure 4-13 thru 4-16.
      b. NRCA BUR/MB-12, 13, and 17,18, 19, 21, 22, 23.
      c. Meet requirements of Section 07 92 00 for sealants and priming.
   3. Where not addressed by details, Specifications or referenced standards, request direction of Architect.

END OF SECTION

SECTION 07 21 00

INSULATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Sound attenuation insulation in interior partition construction.

B. Related Requirements:
   1. Energy calculations or prescriptive compliance documents.

1.02 REFERENCES

A. ASTM - American Society for Testing and Materials
   1. ASTM C 165 - Test Method for Measuring Compressive Properties of Thermal Insulations
   2. ASTM C 356 - Test Method for Linear Shrinkage of Preformed High-Temperature Thermal Insulation Subjected to Soaking Heat
   3. ASTM C 612 - Mineral Fiber Block and Board Thermal Insulation
   4. ASTM C 665 - Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
   5. ASTM C 1104 - Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation
   6. ASTM C 1304 - Test Method for Assessing the Odor Emission of Thermal Insulation Materials
   7. ASTM C 1338 - Test Method for Determining Fungi Resistance of Insulation Materials and Facings
   8. ASTM D 816 - Rubber Cements
   9. ASTM E 84 - Surface Burning Characteristics of Building Materials
   10. ASTM E 96 - Test Methods for Water Vapor Transmission of Materials
   11. ASTM E 136 - Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C

B. CBC - 2007 California Building Code
   1. CBC-7 – CBC Chapter 7, Fire Resistance Rated Construction

C. Title 24 California Code of Regulations Part 6 California Energy Code, Section 118, 2007.

D. SCAQMD – South Coast Air Quality Management District Regulations Rule 1168 Adhesive and Sealant Applications.

1.03 PERFORMANCE REQUIREMENTS

A. Materials shall provide continuity of thermal barrier at building enclosure elements.

B. Materials shall conform to Section 719, California Building Code and Section 118 California Energy Code.

1.04 SUBMITTALS

A. Product Data: Provide data on product characteristics, performance criteria and methods of installation.

B. Three samples of each material specified minimum 12 inches square. Provide fasteners, clips and other accessories.

C. Certification of Compliance with Section 118 California Energy Code, 2007 and Part 12, Title 24,CCR Standards for Insulating Materials Chapter 12-13, Section 12-13-1555.

1.05 QUALITY ASSURANCE

A. Provide R-value in accordance with Section 143, Table 143-A of 2007 California Energy Code, Title 24 Part 6 California Code of Regulations.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products of following manufacturers form basis for design and quality intended.
   1. Johns Manville Insulations, Commercial/Industrial Division, Denver, CO.
   2. Certainteed Corporation, Valley Forge, PA.
   3. Owens - Corning, Toledo, OH.
   4. Thermafiber Division of USG Corp., Wabash, IN.

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

2.02 MATERIALS - SOUND

A. Sound Attenuation Insulation: ASTM C665, Type I; preformed glass fiber, formaldehyde-free, "Sound Control Batts", acoustical fiber glass insulation, by Johns Manville or equal. Conforming to the following:

1.	Size	As required to fully fill cavity width and height.
2.	Thickness	3-5/8" for 4" walls and 6-1/2" for 6" walls, minimum.
3.	Facing	unfaced
4.	Flame Spread	Less than 25, ASTM E84
5.	Smoke Developed Rating	Maximum 50
6.	Formaldehyde-free	
7.	Recycled Content	Minimum 25 percent.

2.03 ACCESSORIES

A. Fasteners, type and size to suit application.

B. Tape: Acrylic with Polypropylene backing, Class A, flame spread less than 25, adhering type, 2-1/2 inch wide; No. 8086 CONTRACTOR SHEATHING TAPE, manufactured by 3m Company, St. Paul, MN, or equal as approved in accordance with Division 01, General Requirements for substitutions.

C. Insulation Fasteners: Steel impale spindle and clinch shield on flat metal base with applied adhesive, length to suit insulation thickness, capable of securely and rigidly fastening insulation in place; INSUL-ANCHORS, manufactured by Gemco, Dansville, OH, or equal as approved in accordance with Division 01, General Requirements for substitutions. Self-adhesive base plates are prohibited.

D. Adhesive: Tuff Bond Hanger Adhesive manufactured by Gemco, Dansville, OH, or equal as approved in accordance with Division 01, General Requirements for Substitutions.

E. String wire: minimum 18 gauge galvanized steel wire.

F. Do not use salvage cut-offs, materials less than space width, or in multiple short lengths to fill-in the gaps.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify site conditions.

B. Verify that substrate and adjacent materials are satisfactorily installed and in place and are ready to receive insulation.

3.02 INSTALLATION

A. Install insulation in accordance with insulation manufacturer's instructions.
   1. Clean tracks prior to installation.

B. Install in cavities designated to receive sound insulation without gaps or voids. Extend material full height of cavity.

C. Cut insulation to fit tightly at cavities between studs not standard 16 inches on center spacing.

D. Trim insulation neatly to fit spaces.

E. Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within the plane of insulation. Leave no gaps or voids.

F. Extend sound materials full height of cavity to structure above and as otherwise required to produce a completely sound insulated enclosure.

G. Tape and seal butt ends, lapped flanges, and tears or cuts in foil in thermal batts.

H. Friction fit semi-rigid sound insulation batts in cavities, no gaps voids permitted.

I. Wood Framing: Place foil side of thermal batts toward inside of building by stapling at 6 inches oc.
   1. Batts under wood framing: Staple flanges to wood supports at 4" centers and ensure batt facings form continuous vapor barrier. Provide tightly stretched string wires along center of horizontal or sloping batts where support spacing exceed 16" on centers. Install batts in exterior walls with vapor barrier facing room.

J. Install material to preclude slipping from place by use of nails, screws, wires or other approved fastening devices.

K. In wall cavities above ceilings with no finish or finish on one side, retain insulation in place with 16-gauge galvanized annealed wires spaced 12 inches on centers vertically.

L. Where tight, congested, difficult or otherwise unforeseen conditions are encountered, employ alternate application methods or materials to effect the intended insulation system. Alternate methods or materials will be approved by Architect.

3.03 INSPECTION

A. Notify Project Inspector before Work is covered. Approval by Project Inspector shall be received before any Work is concealed. Work that has been covered prior to inspection and approval shall be uncovered for inspection and recovered.

END OF SECTION

SECTION 07 51 15

COLD PROCESS MONOLITHIC BUILT-UP ROOFING

PART 1 – GENERAL

1.01 SUMMARY

A. Furnish necessary material and labor to install Henry Roof System Specification or approved equal following the requirements of this Master Specification and site specific Scope of Work

B. Other work included: Furnish and install sheet metal, metal pan collar flashing, pipe flashings and counterflashing.

1.02 REFERENCES

A. National Roofing Contractors Association (NRCA) Roofing and Waterproofing Manual

B. Western States Roofing Contractors Association (WSRCA)

C. SMACNA

D. Underwriters Laboratories (UL)

E. American Society of Testing & Materials (ASTM)

F. California Building Code (CBC)

1.03 DEFINITIONS

A. UNDERLAYMENT, BUFFER or BASE PLY– 80# Base sheet – first ply installed over wood deck or #604 25# Fiberglass Base Sheet or #607 33# Fiberglass Base Sheet installed over wood deck or insulation.

B. INTERPLY – 2, 3 or 4 layers of #604 25# or #607 33# Fiberglass Base Sheet installed over Insulation or Underlayment.

1.04 SYSTEM DESCRIPTIONS

A. Henry Specification #H4-NMC-MR - Slopes 0 – 1/8" - *(See 3.05)*
Over prepared deck surface, install 80# SBS Underlayment (#606), three layers of 30# SBS Base Sheet (#608), Monolithic System (9 gal. #107 Emulsion reinforced with 3 lbs. #189 Fiberglass), 2 gallons #107 Emulsion & broadcast 40 lbs. granules, and #280 White Elastomeric Coating as specified.
Specification System & Weights per 100 Sq.ft. Dry Weights

	#606	80# SBS Underlayment - Mechanically fastened	80 lbs.
	#902	Permanent Bond Adhesive – 2 gallons per 100 sq.ft.	11 lbs.
*	#608	30# SBS Base Sheet	30lbs.

	#902 Permanent Bond Adhesive – 2 gallons per 100 sq.ft.	11 lbs.
*	#608 30# SBS Base Sheet	30lbs.
	#902 Permanent Bond Adhesive – 2 gallons per 100 sq.ft.	11 lbs.
*	#608 30# SBS Base Sheet	30lbs.
	#107 Emulsion topcoat – 9 gallons per 100 sq.ft.	36 lbs.
	#189 Chopped Fiberglass – 3 lbs. Per 100 sq.ft.	3 lbs.
	#107 Emulsion topcoat – 2 gallons per 100 sq.ft.	9 lbs.
	Granules	40 lbs.
	#280 White Elastomeric – 3 gallons	20 lbs.
	Approximate Total Dry Weight	311 lbs.

1.05 SUBMITTALS

A. Fire Hazard Classification - Provide letter certifying that roof membrane assembly qualifies for UL Class A fire hazard classification for the type of substrate(s), slope(s), insulation(s) (when applicable) and membrane(s) specified for this installation. Include copy of the UL listing.

B. Applicator approval - Provide letter from manufacturer of roofing materials stating that applicator is acceptable to manufacturer.

C. Complete materials list of all items to be furnished and installed under this Section.

D. Copy of latest edition of the Roofing System Manufacturer's material specifications and installation instructions.

E. Two (2) 3" x 5" samples of roof membrane mock-up and flashing membrane.

F. Copy of Manufacturers Warranty.

1.06 SUBMITTALS OF EQUALS

A. Submittals shall be made not less than ten (10) days prior to bid date. Primary roof systems that have been reviewed and accepted as equals to the specified roof system will be listed in an addendum prior to bid date; only then will equals be accepted at bidding. All submittals that do not conform to the following requirements will be rejected.

B. Furnish in triplicate:
   1. 8" x 10" mock up samples of the complete roof membrane and flashing membrane assemblies.
   2. Latest edition of the roofing system manufacturer's specifications and installation instructions.
   3. Detailed descriptive list of the materials proposed for use.
   4. Copy of UL approval of the proposed roofing system for the required assembly and slope. No other testing agency approvals will be accepted.
   5. Letter from the proposed primary roofing manufacturer confirming the number of years it has directly manufactured the proposed primary roofing system under the trade name and/or trademarks as proposed.
   6. List of ten (10) of the manufacturer's projects located within 25 miles of the project site of equal size and degree of difficulty that have been performing

successfully for a period of at least ten (10) years. Include contact name and phone number.

7. Complete list of material physical properties including solids. Owner reserves the right to request documentation from a nationally recognized independent lab certifying physical properties.
8. Copy of manufacturer's inspection form.
9. Qualifications of manufacturer's inspector(s)
10. Proposal from manufacturer for site specific quality control program.
11. Sample copy of the specified guarantee including terms and procedures for renewal.
12. Documentation that manufacturer meets requirements of 1.06A.

1.07 QUALIFICATIONS

A. Manufacturer Qualifications
1. Manufacturer shall be a member in good standing with the Southern California Roofing Contractors Association, Western States Roofing Contractors Association, National Roofing Contractors Association, Construction Specifications Institute, and California Association of School Business Officials.
2. Manufacturer must furnish as single source all primary roofing materials with manufacturer's labels and have current listing in Underwriters Laboratory Directory. Materials must bear UL Classification marking on bundle, package or container indicating that materials have been produced under UL's Classification and Follow-up Service.
3. Manufacturer must provide list of 10 projects of equal size and difficulty within a 25-mile radius of the project site.
4. Manufacturer shall employ a full-time field inspector available for periodic inspections (not less than twice weekly) and final inspections. Inspection reports to be available to the Owner Representative on request.
5. Manufacturer must employ a Registered Roof Consultant and Registered Roof Observer certified by the Roof Consultants Institute.

B. Contractor Qualifications
1. Contractor must provide list of 3 projects of equal size and difficulty within a 50-mile radius using the specified roof system.
2. Contractor must provide a supervisor that can communicate with Manufacturer's Inspector and Owner Representative.
3. Contractor must provide knowledgeable foreman who understands all aspects of the specification.
4. Contractor to be a member in good standing with the local Roofing Contractors Association.

1.08 QUALITY ASSURANCE

A. Regulatory Requirements: The applicator shall submit evidence that the proposed roof system meets the requirements of the UL listing and has been tested and approved or listed by the following test organizations:
1. Factory Mutual Research Corporation (FM), Norwood, MA.
   a. Class 1-90.
2. Underwriters Laboratories, Inc., Northbrook, IL.
   a. Class A Assembly.

B. Pre-Job Conference
   1. Prior to the beginning of work, a pre-job conference shall be held at the job site.
   2. Provide seven calendar days advance written notice ensuring the attendance by competent authorized representatives of the Henry Certified Contractor (HCC), a Henry Company representative, building owner, architect, consultant, and subcontractors including mechanical and electrical where such work penetrates the work of this Section.
   3. During the pre-job conference, attendees shall review the specifications to determine any potential problems, changes, etc. Scheduling, weather conditions, unique job site conditions, installation requirements and procedures and any other information pertinent to the roof system installation shall be discussed.
   4. The results of the conference shall be recorded with copies submitted to all participants

A. Notify Henry Company Inspector 48 hours prior to job start, schedule changes and prior to application of surfacing and reflective coat.

B. A copy of the specification is to be on the job site.

1.09 DELIVERY, STORAGE & HANDLING

A. Delivery Requirements
   1. Deliver material in manufacturer's original sealed and labeled containers and in quantities required allowing continuity of application.

B. Storage Requirements
   1. Store materials out of direct exposure to the elements. Store roll goods on a clean flat surface. Protect material against moisture. Store asphalt adhesives and cements in a heated area prior to use in cold weather.
   2. When ambient temperatures are below 40°F (4°C), rolled materials must be stored in protected or heated areas and brought to the roof as needed for application.

C. Handling Requirements
   1. Handle material in such a manner as to preclude damage and contamination with moisture or foreign matters
   2. Materials that are found to be damaged or stored in any manner other than as stated above shall be automatically rejected and shall be removed and replaced at contractor's expense.

1.10 JOB CONDITIONS

A. Protection Requirements.
   1. Protect building and grounds from overspray, staining and mechanical damage. Plank lawns, walks, etc. in traffic areas.
   2. Applicator will be held responsible for any damage caused to roof top equipment, roof penetrations, clogged drains (if not identified prior to starting the work) and damage to building and grounds resulting from the execution of his work.
   3. Lock valves on tankers when not attended.
   4. Cover or arrange air intakes to be turned off during application of solvent-based materials.

B. Environmental Requirements.
   1. Do not apply material during precipitation or when rain is a probability during or after application before material can set.
   2. Never apply solvent-based adhesives or coatings to a wet surface.
   3. Never apply water-based emulsions when the ambient temperature is below 60°F (16°C) or will fall below 40°F (4°C) before the emulsion has cured to a tack-free black surface. High humidity, fog and dew will greatly extend the time for emulsions to cure.
   4. Protect adjacent surfaces from staining and mechanical damage during application of roofing.

1.11 WARRANTY

A. CONTRACTOR WARRANTY
   1. Prior to acceptance of the roofing work, furnish certified written warranty signed by Roofing Contractor agreeing to make repairs and replacements required to maintain roof, including flashing, in watertight condition for two years from date of substantial completion.
   2. Make repairs or replacements at no additional cost to Owner.
   3. Warranty shall include temporary repair work under emergency condition as required to maintain water tightness of the building pending permanent repairs.

B. MANUFACTURER'S WARRANTY
   1. Furnish Manufacturer's 10 + 10 -year Warranty for material and workmanship. No exceptions to ponding water. There is to be no additional warranty or inspection fees for the 10-year extension.
   2. Manufacturer to make inspection in the 2nd and 10th year of the warranty period.

1.12 MAINTENANCE
A. Furnish Owner with annual maintenance requirements to maintain contractor and manufacturer's warranties.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Materials manufactured or supplied by Henry Company, Huntington Park, CA.

B. Products by Tremco and Garland equal to the specified materials are also approved.

C. Products by other manufacturers must be submitted 10 days prior for approval in accordance with Section 1.06 of these specifications.

2.02 PRODUCT DELIVERY

A. Bulk delivery material shall be accompanied by a Henry Company bill of lading.

2.03 MATERIALS

A. GENERAL: Refer to Project Scope of Work for applicable product references.

B. Sheathing paper (wood decks only) -1 ply

C. UNDERLAYMENT OR BUFFER PLY
   1. #606 80# SBS Underlayment

D. INSULATION
   1. Polyisocyanurate insulation ASTM C-1289-95
   2. Density - ASTM D1622 – nominal 2 pcf
   3. Compressive strength - ASTM D1621 – nominal 20 psi
   4. Polyisocyanurate insulation overlay of minimum ½ inch perlite, fiberboard or 1/8" Henry Recover Board. Combined R-value of 19.
   5. Mechanical fasteners – corrosion resistant – listed with Factory Mutual
   6. Insulation adhesive: #111 InsulBond applied at rate of 2 to 2 ½ gallons per 100 sq.ft.

E. INTERPLY
   1. #608 SBS 30# Ply Sheet

F. INTERPLY ADHESIVE – 2 Gallons/Sq/Ply:
   1. #902 Permanent Bond Adhesive – low odor, modified and rubberized cold adhesive

G. BASE FLASHING
   1. modifiedPlus NP180 s/s – SBS modified membrane, polyester reinforced.

H. MONOLITHIC SURFACING (9 Gallons with 3 lbs. Glass/Square):
   1. #107 Asphalt Emulsion – ASTM D 1227-95 Type III, Class I
   2. and #189 Chopped Fiberglass

I. SURFACING
   1. #107 Asphalt Emulsion
   2. and granules (40#)

J. REFLECTIVE SURFACING (as specified in Project Scope of Work)
   1. Premium Elastomeric Coating: #280 White, #282 Tan

K. MISCELLANEOUS PRODUCTS
   1. Primer #103 VOC Compliant Primer
   2. #504 Plastic Cement
   3. #600 Ruftac – 75 mil - SBS modified self-adhesive membrane
   4. #209 ElastoMastic
   5. #183 Reinforcing Glass – Yellow
   6. #196 Polyester Fabric
   7. #107 Asphalt Emulsion
   8. #109 Liquid Roof - Neoprene Modified Emulsion
   9. #176 Pond Patch
   10. Walk pads: 5/16 inches thick, 32 by 32 inches. Preformed skid-resistant, modified asphalt panels consisting of reinforcement and fillers, ceramic granules. DynaTred Roof Walkway by Johns Manville, or as recommended by roofing manufacturer.
   11. Approved mechanical fasteners

12. Wolmanized wood nailers
13. Replacement metal to be 24 gauge galvanized sheet metal
    a. Metal edging to have maximum ¼" rise.
    b. All flanges to be 4 inches with full corners
    c. Pitch pans to have soldered joints.
14. Lead Flashings to be minimum 4 #. – factory or field soldered
15. Josam or Smith drains and overflows
16. ChemCurb pitch pockets (approved in lieu of galvanized pitch pockets)
17. Four inch cant strips ASTM C-208

PART 3 – APPLICATION

3.01 GENERAL

A. Henry Company's General Requirements and Product Data are a part of this specification.

B. Do not tear-off or remove any more roofing than can be replaced the same day.

C. Unless sheet metal components are specified for replacement carefully remove, clean, prime and set aside for reinstallation. Carefully turn up counterflashing.

3.02 EXAMINATION

A. Inspect deck and advise Owner's Representative of any corrections required before proceeding with roofing. Report in writing any unsatisfactory conditions that cannot be guaranteed. Absence of such report constitutes acceptance of the surfaces and conditions.

3.03 PREPARATION

A. Sweep or vacuum all surfaces prior to commencement of roofing. Allow surface to dry before proceeding.

B. Cut ply sheets into 18-foot lengths. Allow plies to flatten before application.

C. All surfaces shall be well-secured, firm, smooth and free from rough spots and sharp projections before roof application begins.

D. Wood decks. Repair and/or renail roof sheathing where necessary. Cover gaps of ½" or more between sheathing board with flat sheet metal stock nailed. Contractor to replace deteriorated sheathing with new to match existing unless specified otherwise under Scope of Work.

E. Test interior drains to confirm that they flow freely. Immediately notify Owner's Representative if correction is required.. Protect drains from plugs of gravel and debris.

F. If not scheduled for new metal, carefully lift or remove metal counterflashing, coping, and gravel stop. Clean metal and set aside for reinstallation.

3.04 GENERAL REQUIREMENTS

A. Install roofing in accordance with roofing system manufacturer's instruction, scope of work for the site and these requirements.

B. Valleys and waterways. Install extra layer of the specified glass base set in full width application of #902 Permanent Bond Adhesive in valleys, drains and waterways.

C. Prime metal flanges (all jacks, edge metal, etc.), concrete and masonry surfaces with a uniform coating of asphalt primer.

D. Thinning or alterations of adhesives, primer, emulsion, reflective coat and sealants is not permitted.

E. Clean all drains and remove clamp rings, dried mastic and any other loose material. Prime with asphalt primer and allow to dry. Install minimum 30" square leads in drains set in #504 plastic cement. When lead is not permitted by Owner install Ruftac. Replace broken or missing clamp rings, bolts or fasteners and drain bonnets with new. Complete drains the same day.

F. Scuppers/Outlets. Set scuppers in 1/8" troweling of plastic cement. Three course flange with plastic cement and glass fabric.

G. Lift all supports for conduits and other pipes. Install new wood blocks under conduit or pipes. Reinforce under block with one layer of 80# Cap Sheet cut 6 inches larger in all directions of block, granules side up, set in generous application of specified plastic cement prior to Monolithic surfacing. Seal top of bolts, screws, etc., with #109 ElastoMastic. Loosen brackets so pipes can expand and contract freely.

H. EQUIPMENT PADS. Install one layer of Ruftac over equipment pads before installing metal pans.

I. PIPE PENETRATIONS, ELECTRICAL JACKS, VENT PIPES EQUIPMENT STANDS
   1. Set flange over base plies set in plastic cement.
   2. Seal with 6" strip of reinforcing fabric sealed solidly with plastic cement. Cut a collar of base sheet to fit around vents and overlap the flanges 6" on sides. Set in application of plastic cement.
   3. Form a plastic cement cant around base of vents prior to the application of the Monolithic surfacing.
   4. Ruftac is an acceptable alternative to I.2.
   5. When specified in project's Scope of Work, install storm collars on all pipe penetrations and jacks.

J. 3-COURSING
   1. Prime wall surface at least 3" above termination edge of the base flashing.
   2. Over completed base flashing trowel a 5-inch wide layer of plastic cement 1/8" thick to completely cover nails and top edge of base flashing.
   3. Embed a 4" wide strip of Yellow Glass Fabric and apply another 1/8" troweling of plastic cement covering fabric completely. Bring to a featheredge and finish in a straight line.
   4. If not covered by metal counterflashing cover with Monolithic Emulsion system.

K. PITCH POCKETS
   1. When required, furnish pans a minimum 4" (102mm) deep with a minimum 4" (102mm) flange.
   2. Install the pans on the finished membrane with the flange set in plastic cement and nailed 3" (76mm) o.c.
   3. Strip in flange with Ruftac or two layers of specified ply sheets set in #902 Permanent Bond Adhesive. Extend plies 4" (102mm) and 6" (152mm) onto roof surface.
   4. Fill base of pan with plastic cement. Slope to facilitate drainage away from penetration.
   5. When specified in project's Scope of Work, install a 24-gauge watertight rain collar overlapping pitch pocket. Secure with drawband and approved sealant.

L. CANT STRIPS. Install cant strip at all horizontal to vertical transitions. Nail or set in specified plastic cement. Set to provide smooth transition without gaps. Miter corners. At scuppers bevel cant strip starting 8" back from outlet.

M. COPING JOINTS: Clean coping joints. Prime 3 inches on both sides of joint and seal joint with 6-inch minimum layer of Ruftac.

N. WATER CUT-OFF. At end of day's work, or when precipitation is imminent, install a water cut-off at all open edges. Install alternating layers of plastic cement and roof felts. Construction is to withstand protracted periods of service. Remove cut-offs completely prior to the resumption of roofing.

O. Roll the membrane with a 75-lb. (34kg) (minimum) weighted roller within 30 minutes to 4 hours of application. Provide waterstops and seal all terminations at the end of each day.

P. On slopes over 3" in 12" (250mm/m), install interplies parallel to slope blindnailing 4" (102mm) at end laps only, 6" (152mm) on center.

Q. WALKWAYS. Install walkways in 4' sections allowing 2" spacing between sheets. Cut and trim pieces as required to fit conditions. Set walkway in spot applications of #504 Plastic Cement..

3.05 Specification H4-NMC-MR (NAILABLE DECK – NO INSULATION)

A. Over diagonal sheathing install one layer of rosin sheathing paper . Lap each sheet 2" (51mm) and nail sufficiently to hold in place.

B. UNDERLAYMENT OR BUFFER Apply #606 80# SBS Underlayment with 2" (51mm) side laps and 4" (102mm) end laps. Apply the first sheet of underlayment with a 12" (305mm) width and the remaining sheets full width.

C. Nail underlayment through one-inch tin disks at side laps 9" (229mm) on center and 18" (457mm) on center, staggered in two rows 12" (305mm) from each edge. Fasteners to be sufficient length to penetrate deck ½ inch.

D. BASE SHEETS
   1. Over the underlayment, apply three (3) layers of #608 30# interply sheets set in a uniform application of #902 Permanent Bond Adhesive at a rate of 2 gallons per 100 sq.ft.
   2. Apply the first sheet with an 18" (457mm) width then over that a full width piece. Install the remaining sheets full width overlapping preceding sheet 19". Stagger laps with the layer below. Run plies to top of cant.

3.06 PONDS AND LOW SPOTS – Only applies when specified in Scope of Work

A. After membrane has been installed, identify and mark low spots for correction.

B. Coat low spots with #107 Asphalt Emulsion at 3 gallons per square. Allow emulsion to cure until it can take foot traffic without scuffing.

C. Mix #176 PondPatch per label instructions and fill low spots. Screed and finish trowel to proper height over the pond area. Feather trowel edges.

D. Allow PondPatch to dry completely. Remove high spots and ridges with a wire brush.

E. Cover with an embedding coat of #107 emulsion at rate of 3 gallons per 100 sq.ft. extending 6 inches onto existing membrane.

F. Embed # 196 Polyester into emulsion and allow to dry.

G. Complete installation to match existing roof.

H. If PondPatch is installed under membrane, installation of a one way roof vent is required.

3.07 METAL EDGING

A. Extend top layer of base sheet over edge of roof approximately 1".

B. Install metal flange over completed membrane but before application of surfacing. Set metal flange in trowel application of plastic cement. Nail 3" (76mm) o.c. staggered.

C. Over prepared surface install 12 inch wide Ruftac over metal flange and extending onto the field of the roof..

3.08 FLASHINGS

A. General Requirements
   1. Prime concrete surfaces with specified primer and allow to dry.
   2. Complete first ply of flashing daily to assure watertight installation.
   3. Install Base Flashing to a maximum 24-inch height.
   4. Ruftac may be used in lieu of modifiedPlus 180, but requires that surface be primed and allowed to dry.

5. Install flashings in two pieces when height exceeds 24 inches. Overlap bottom layer 3 inches.
6. Reinforce and make watertight all angles with one layer of modifiedPlus 180 s/s to extend two (2) inches above cant and two (2) inches onto field. Coat substrate and back of sheet with 902 Permanent Bond Adhesive at rate of 1 gallon per 100 sq.ft. per side. Allow to tack. May require approximately 30 minutes airtime to be tacky. Press in place. Lap sides 3 inches.
7. Unless otherwise specified 3-course top edge with #504 Plastic Cement and #183 Yellow Glass

B. Install Flashing Specification Number #180
1. Cut layer of modifiedPlus180s/s to extend not less than 4" (51mm) above cant strip. Coat back of cap ply and wall with #902 Permanent Bond Adhesive at rate of ¾ gallon/100 sq.ft. (.3 l/m²) each side. Allow sheets to set until tacky. Press sheet in place. Lap ends 4" (102mm).
2. Nail top of completed base flashings 8" (204mm) o.c.
3. Provide counterflashing with minimum 4" (102mm) face installed in reglet or surface mount.
4. Apply compatible sealant.

C. Wall Flashings
1. Wood Walls. Nail #605 granule side out. Nail 12 inches on center in all directions and 6" on end laps. Extend wall flashing over base flashing three inches.
2. Concrete Walls. Unless otherwise specified, cover the inside and tops of concrete parapet walls with one layer of Ruftac. Extend membrane over base flashing three (3) inches and to within 3 inches of outside wall. Rub in firmly by using a wallpaper roller bonding Ruftac without wrinkles or loose areas. Nail top edge through one-inch tin disks eight (8) inches o.c.
3. Masonry Block Walls. Unless otherwise specified cover the inside and tops of masonry block walls with one layer of polyester embedded in 4 gallons of 107 Asphalt Emulsion. Side laps to be three (3) inches. Extend over base flashing three (3) inches and to within 3 inches of outside wall. Polyester to be fully embedded and without wrinkles.

3.09 SURFACING; Monolithic System

A. After the adhesive has thoroughly cured (no solvent odor is evident and laps cannot be pulled apart), but not less than five days, sweep or pressure blow dust and debris from the roof surface to provide a clean surface. Hose and/or scrub off with water any residue accumulation.

B. Protect adjacent walls not scheduled for emulsion and reflective coating. Protect equipment, roof top units, valves, switches, coils or moveable parts etc. not scheduled to receive Monolithic application from overspray. Mask off identification plates on equipment.

C. Clean gutters prior to surfacing.

D. Cover prepared surfaces with not less than 9 gallons (34l) per 100 sq.ft of undiluted #107 Asphalt Emulsion. Evenly blend emulsion with 3 lbs. (1.4kg) of ¾" (19mm) long chopped glass reinforcing sprayed with equipment approved by Henry Company. Tufting of the glass fibers is not acceptable. Spray emulsion in pattern into laps of base sheet so that when system is dry, there is no voids or bridging of glass over any seam of the membrane.

E. Unless otherwise specified, spray vents, ducts, and parapet walls. Spray parapet walls to within one inch of outside edge; above reglets and/or 5-course counterflashing.

F. Spray base flashings and other designated surfaces with the Monolithic System.

3.10 REFLECTIVE COATING:

A. As soon as emulsion surfacing has cured (tack-free and black), clean the surface of dust and debris. After five (5) days hose roof surface and scrub out any pockets of residue.

B. Apply #280 White Elastomeric Coating at the rate of 1½ gallons per 100 square feet (.6l/m²) in one coat.

C. Any areas that peel must be redone before the project will be considered complete.

D. In arid climates when rain is unlikely within 30 days of application of the aluminum coat, hose roof surface 30 days after application.

3.11 CLEAN-UP

A. Test all drains to confirm they are free flowing and clear of debris.

B. Clean gutters and downspouts as needed of all debris.

C. Any deficiencies found during final inspection will be corrected within 5 working days and will be re-inspected by a Manufacturer's Representative and Owner's Representative.

D. Leave premises clean to complete satisfaction of the Owner.

END OF SECTION

SECTION 07 57 00

SPRAYED POLYURETHANE FOAM ROOFING SYSTEM

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Sprayed Polyurethane Foam Roofing System, as shown on drawings and specified herein.

1.02 SYSTEM DESCRIPTION:

A. Roofing System shall be UL-790 (ASTM E-108) Class A and UL-723 (ASTM E-84) Class I, and conform to UBC Sections 1501-1510 and UBC Code Standard 15-2. System shall meet UL-1256 Construction Methods #136, #181 and #206. Roofing System shall meet UL-1897 Standard for Wind Uplift and UL-2218 Standard for Impact Resistance. Roofing System shall meet required ICBO acceptance criteria and/or FM Global approval standards, and "Energy Star" Guidelines.

B. Roofing System shall be Class B over Combustible Deck and conform to ASTM Test Standards, ICBO, FM, and UBC Requirements.

C. 10 Year Warranty System
   1. 1-4 inches of spray-applied polyurethane foam (depending upon insulation value required) on deck, a 25-mil thickness of white 100% acrylic roof coating with #9 white limestone granules or #11 ceramic granules imbedded into or on top of the wet coating at 30 pounds per 100 square feet. The roof system will provide a ten (10) year, no-leak warranty.
   2. Low cost sustainable foam roof system is easily maintained, repaired and upon inspection, may be re-coated with acrylic elastomeric UV protective coating after 10 years.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's material specifications, installation instructions and evidence of UL, ICBO and/or FM ratings for roofing system.

B. Provide specimen copy of the applicable warranty for this project, as specified herein.

C. Evidence that Sprayed Polyurethane Foam Roofing System is approved in accordance with UL-790 Class A and UL-723 Class I Testing.

D. Evidence that Sprayed Polyurethane Foam Roofing System meets in accordance with Ul-2218 Impact Resistance Testing.

E. Evidence that Sprayed Polyurethane Foam Roofing System meets in accordance with UL Report P-904 Testing for minimum 2-Hour Fire Rating on structural concrete deck.

1.04 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer: Company specializing in manufacturing products specified with minimum 5 years documented experience.
   2. Applicator: Roofing applicator with 5 years experience in work of similar scope and nature to that specified and approved by manufacturer of roofing material.

B. Pre-Installation Conference:
   1. Convene a pre-construction conference to review roofing specifications and procedures with the architect, contractor, roofer and other trades relative to the work, prior to ordering materials.

1.05 DELIVERY, STORAGE AND HANDLING

A. Delivery
   1. Deliver materials to site intact with labels showing UL listings.
   2. Deliver so that stocks of materials on the site will permit uninterrupted progress of the work.

B. Storage and Handling
   1. Adequately protect against damage while stored at the job-site.
   2. Comply with manufacturer's instructions.

1.06 PROJECT/SITE CONDITIONS

A. Polyurethane foam shall not be sprayed during inclement weather and when the following conditions exist:
   1. If surface temperature is above 160 degrees F or below 40 degrees F or when the dew point is less than 5 degrees F above the surface temperature.
   2. If surface moisture is present.
   3. If wind velocity is above 12 miles per hour windscreens are required; for wind velocity at or above 25 miles per hour work shall be suspended.

1.07 WARRANTY

A. Warranty: Furnish written Ten (10) Year No Leak Warranty on Sprayed Polyurethane Foam Roofing System. Warranty shall cover repairs necessary to maintain roofing work in a watertight condition during the warranty period. Warranty is to cover workmanship and materials during the period covered.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Products of following manufacturers form basis for design and quality intended.
   1. SWD Urethane Company
   2. Bay Systems North America.
   3. Henry Company/Resin Technology.
   4. Dow Chemical

5. Resin Technology Corporation, Ontario, CA.

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

2.02 MATERIALS

A. Primer/Sealer
1. Neoprene based primer formulated to be airless sprayed and designed expressly to enhance adhesion of urethane foams to various surfaces.
2. Manufacturer's Primer/Sealer.

B. Polyurethane Foam Roofing/Insulation
1. Two component rigid foam, designed to be applied with foam dispensing equipment, meeting the following Minimum Physical Properties:

PHYSICAL PROPERTIES

	Property	Procedure	Values
a.	Density, pcf nominal	D-1622	2.0 2.5 3.0
b.	Compressive, psi	D-1621	35 40 50
c.	Tensile, psi	D-1623	60 70 85
d.	Shear, psi	D-273-61	40 45 50
e.	Closed Cell Content %	D-2865-70	95 95 95
f.	Permeance, perm/in	E-96	2-3 2-3 2-3
g.	K Factor (initial)	C-177	0.148

h. Polyurethane Foam Density and Compressive Strength shall be uniform and consistent with specification Minimum Physical Properties and shall not allow for multiple foam densities or compressive strengths to be applied within multiple inches of foam specified.

C. Protective Coating
1. 100% acrylic elastomer, UL 723 Class I rated, white coating meets EPA "Energy Star" guidelines for solar reflectance can be applied by brush, roller or conventional airless spray equipment with the following Minimum Physical Properties:

PHYSICAL PROPERTIES

	Property	Procedure	Values
a.	Solids Content:		
	1) By Weight	D-1353	70± 4%
	2) By Volume	D-2697	60 ± 4%
b.	Solar Reflectance	ASTM E-903	85%
c.	Ultimate Tensile Strength:		
	1) Psi	ASTM D-412	280
d.	Elongation at Break:		
	1) Psi	ASTM D-412	355
e.	Permeance:		
	1) Perms @ 20 mils	ASTM E-96	3.5

f. Hardness:
   1) Shore A Durometer ASTM D-2240 60
g. Colors: Grey, Buff, White

2. Dry film thickness shall be 25 mils application with #9 limestone granules or #11 ceramic granules embedded at 30 lbs per 100 square feet.
3. Base coat and top coat should be contrasting colors to ensure adequate thickness and coverage.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions:
   1. Roofing contractor shall examine the roof deck, flashings and other surfaces that are to receive roofing materials, prior to the application to ensure that surfaces are dry, clean and in proper condition to receive the roofing system.
   2. All penetrations through roofing including drains, scuppers, miscellaneous pipe and vent penetrations and electrical conduits shall be completed prior to starting of work. Post-installation of penetrations after roofing section is completed requiring repairs shall constitute costs added above contracted scope of work.

B. Application of roofing material shall constitute the roofing contractor's acceptance of surfaces and flashings to receive the materials.

C. Coordinate with other work and trades that affect, connect with or will be covered by this work.

3.02 PREPARATION

A. General Area:
   1. Notify the owner's representative and visitors to the job-site of potential fugitive overspray.
   2. Cars, etc. should be moved or covered to prevent inadvertent spraying. Contractor shall coordinate traffic with subcontractor during roof operations.
   3. Provide all barricades, as required so that there is no doubt that the area is completely barricaded.
   4. Use appropriate barricading methods to shelter walking traffic from the work area's equipment and overspray.
   5. Mask work area as necessary to protect building walls, adjacent structures and vegetation, etc. from possible overspray.

B. Deck:
   1. Must be free from dust, oils, loose and foreign materials presenting a clean and smooth surface ready for installation and optimum foam system adhesion.
   2. Surface must be dry before commencement of roofing application.
   3. Metal surfaces shall be free of moisture, rust, dirt and other foreign materials.

C. Surface Preparation for Different Roof Decks

1. Built-up roof or other existing roofs (Retro-fit).
   a. All loose gravel, dust and residue shall be removed using power vacuum equipment, power sweeper, air blowing or other suitable means. (Special conditions may be required if asbestos products are a part of roof removal.)
   b. The roof shall be thoroughly inspected or tested to determine if moisture is present within the roof assembly. Saturated insulation must be removed and replaced with compatible materials.
   c. The existing roof shall be thoroughly inspected for adhesion between felts, insulation and deck. Areas of poor adhesion should be fastened. Blisters, buckles, wrinkles and fish-mouths shall be cut out and/or fastened.
   d. All soft mastic or asphalt materials that impede polyurethane adhesion shall be removed.
   e. Remove or re-fasten all loose base flashing, counter-flashing and gravel-stops as required.
2. Wood Deck
   a. Deck must meet building code requirements for resistance to wind uplift.
   b. Plywood shall contain no more than 18% water, as measured in accordance with ASTM Standards. Plywood shall be exterior grade not less than ½" thick, nailed firmly in place.
   c. Un-treated and un-painted surfaces shall be primed with an exterior-grade primer. Priming is required to minimize moisture absorption and eliminate potential polyurethane foam adhesion problems.
   d. Plywood joints in excess of ¼", shall be taped or filled by others with a suitable sealant material, prior to application of polyurethane foam.
   e. Deck shall be free of loose dirt, grease, oil or other contaminants prior to priming or foam application. Remove loose dirt or debris by use of compressed air, vacuum or broom. No washing shall be permitted.
   f. Tongue & Groove Sheathing or Planking: Due to the frequency of joints, possibility of variable openings and effects of aging and shrinking, these surfaces must be overlaid with a minimum of ¼" thick exterior grade plywood or other suitable covering with a minimum 1" thickness.

3.03 INSTALLATION – GENERAL

A. Install all materials in strict compliance with all published safety, weather or applicable instructions from the manufacturer and/or regulations of local, state and/or federal agencies, which have jurisdiction.

B. Notify the architect in writing of any defect in the deck assembly detrimental to the proper functioning of the new roof system. No work shall be commenced over defective area until advised in writing by architect of the action to be taken in such areas. The commencement of work on the defective areas of the roof deck shall signify the contractor's acceptance of such decks for the application of the specified roof system.

C. Spray polyurethane foam for new construction projects shall be installed when the deck, parapet walls, rough openings and curbs are completed. The type of skylight used will determine when skylights should be installed. Plumbing vents, drains and electrical penetrations shall be in place prior to foam installation. No trades-people shall be allowed to work on the roof when the spray polyurethane foam and coating are being installed. HVAC units shall not be installed until after the foam and coating roof system is in place.

D. Substrate shall have sufficient structural strength and integrity without substrate deformation, and sufficient Slope-to-Drain per Code Requirements of ¼ Inch/Ft. to eliminate excessive ponding water. Excessive ponding is defined as "an area of 100 square feet or more which holds in excess of ½" of water, as measured 48 hours after a rainfall" per The NRCA Roofing and Waterproofing Manual-Fourth Edition.

E. Metal: Install metal foam-stop at all roof edges, as required.

F. Crickets and Cants
   1. The required drainage slope gradients are required to meet the various drainage sources.
   2. Crickets may be constructed as follows:
      a. Using ½" CDX plywood and structural lumber adhered mechanically to the substrate and vertical walls installed by others.
      b. Using spray polyurethane foam (within certain sloping requirements).
      c. Using tapered insulation board that shall be secured to the substrate with an adhesive recommended by the tapered board manufacturer or with mechanical fasteners.
   3. Cants formed with spray polyurethane foam shall transition from the deck surface up the parapet wall.

G. Parapets
   1. The polyurethane foam shall extend a minimum of 4" and/or to 12" up the vertical wall at a thickness of ¾ inch to one-inch (1 ½ inch at the cant).
   2. If it is required that polyurethane foam extend all the way up the parapet wall then foam termination shall be detailed via straight line and tapered foam or optional sheet metal flashing that is acceptable to architectural standards.

3.04 INSTALLATION – PRIMER/SEALER

A. Apply primer/sealer type specified in section 2.02A. Primer/Sealer shall not be applied on any wet decking or oily materials.

B. All surfaces should be clean and free from moisture, oil, grease, loose particles, dust, debris and any other materials that shall prevent maximum adhesion.

C. Spray primer/sealer to decking at a rate of ½ gallon per 100 square feet.

D. Application of spray foam over primer shall be per manufacturer's recommendations.

3.05 INSTALLATION – POLYURETHANE FOAM

A. Apply polyurethane foam type, as specified in section 2.02B.

B. Foam shall be applied in minimum ½" thick passes to achieve the specified thickness ± ¼ inch per inch thickness.

C. Spray only the area each day that can be completed to the specified thickness that same day. Before resuming spraying operations on subsequent days, inspect the exposed leading edge of the foam for possible surface moisture that could cause blistering. The foam edge shall be considered dry when there is no indication of moisture when blotted with an absorptive material.

D. Surface texture and quality" Cured polyurethane foam shall range from a smooth to heavy "orange peel" finish. Textures described as "popcorn" or "tree bark" surfaces, which exhibit crevices, voids and widespread defects, are not acceptable.

E. There shall no soft or spongy areas with hard or brittle strings or improperly proportioned material. Improperly proportioned material applications evidenced by soft, spongy areas shall be cut out and re-sprayed with properly ratioed material.

3.06 INSTALLATION – ACRYLIC ELASTOMERIC PROTECTIVE COATING

A. Preparation
   1. Foam surface and adjacent surfaces to be coated, shall be completely free of degraded foam, foam over-spray, grease, oil or other contaminants which interfere with proper coating adhesion.
   2. Surface shall be dry and frost-free before coating. Do not apply coating materials when surface temperature is less than 50 degrees F.
   3. Any physical damage to the polyurethane foam shall be repaired before coating.
   4. Operator should wear soft-soled shoes to avoid damaging the skin of the foam.
   5. White coating that meets "Energy Star" guidelines are high-reflectance coatings. It is recommended that operators wear sunglasses to avoid temporary blinding effects due to glare.
   6. An additional application of base coat shall be applied where foam surface has been sanded, planed or trimmed and the skin removed prior to applying normal base coat to the entire area.
   7. The polyurethane foam shall be inspected for suitability of base coat application, prior to application of the protective coating and be free of UV oxidation and contaminants.

B. Application:
   1. Base Coat
      a. Shall be a contrasting color from the top coat to insure adequate coverage.
      b. Shall be applied on the same day, as the polyurethane foam application when possible.
      c. The polyurethane foam shall be inspected for UV oxidation if more than 72 hours has elapsed prior to application of base coat.

d. Spray-apply acrylic elastomeric base coat over insulation at the rate of 1 to 1 ½ gallons per 100 square feet in one application, depending on specified mil thickness to be achieved.

e. Use of sealant and/or hand application of coating to small "detail" areas, either for repair or to insure a waterproof seal, shall be done, as soon as possible after the base coat application and prior to application of the finish or top coat.

2. Top Coat

a. Coating shall be a contrasting color from the base coat to ensure adequate coverage.

b. Do not apply top coat until base coat has cured properly. Normally, 24 hours is sufficient time for the base coat to properly cure.

c. Spray-apply acrylic elastomeric top coat over the base coat at the rate of 1 to 1 ½ gallons per 100 square feet in one application, depending on the mil thickness desired.

d. Coating passes shall be applied in cross-hatch pattern at right angles to base coat passes to ensure more uniform coverage.

e. Coating shall extend up and over all polyurethane foam on vent pipes, parapets and other penetrations and shall terminate a minimum of 4 inches above the foam. All top coat termination points shall be straight-lined on walls, parapets, vent pipes and other penetrations.

3. Granules

a. Granules when specified, shall be broadcast into wet top coat while it is being applied at the rate of 30 pounds per 100 square feet.

b. Shall consist of #11 ceramic granules or #9 limestone granules.

3.07 CLEANING

A. Remove and dispose of excess materials, equipment and debris from premises during work and/or upon completion of work.

B. Leave work in clean condition in accordance with general condition requirements.

END OF SECTION

SECTION 07 62 00

SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Fascias and scuppers.
   2. Roof flashings.
   3. Reglets and counterflashing over bituminous base flashings.
   4. Roof joint cover flashings.
   5. Gutters
   6. Downspouts and Strainers.
   7. Conductor Heads.
   8. Gravel Stops.
   9. Plumbing Vents.
   10. Counterflashings for roof hatches and skylights.
   11. Interior Roof Drains.
   12. Flashings for electrical conduits, mechanical lines and plumbing waterlines roof penetrations.
   13. Door drips.
   14. Equipment Roof Curbs and Flashing.
   15. Equipment support stand penetrations.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)
   1. ASTM A653/A653M-98 - Sheet Steel, Zinc-Coated (Galvanized) or Zinc - Iron Alloy Coated by the Hot-Dip Process
   2. ASTM B32 - Solder Metal
   3. ASTM B370 - Copper Sheet and Strip for Building Construction
   4. ASTM B749 - Lead and Lead Alloy Strip, Sheet and Plate Products
   5. ASTM D4601 - Asphalt-Coated Glass Fiber Base Sheet Used in Roofing

B. National Roofing Contractors Association (NRCA)
   1. NRCA Manual - Fifth Edition.

C. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA)
   1. SMACNA Manual - Architectural Sheet Metal Manual, Current Edition

1.03 SUBMITTALS

A. Shop drawings showing material profile, jointing pattern, jointing details, fastening methods and installation details.

B. Product data.

C. Manufacturer's installation instructions.

D. Samples for each type of sheet metal flashing and trim indicated with field-applied color finishes.

1.04 STORAGE AND HANDLING

A. Stack preformed and pre-finished material to prevent twisting, bending, or abrasion and to provide ventilation.

B. Prevent contact with materials during storage that may cause discoloration, staining or damage.

PART 2 - PRODUCTS

2.01 SHEET MATERIALS

A. Galvanized Steel: ASTM A653/A653M-02, G90.

B. Aluminum: 6063-T5 Alloy.

C. Lead Sheet: ASTM B-749, L51121 Grade.

2.02 ACCESSORIES

A. Fasteners: round head, galvanized steel with soft neoprene washers at exposed fasteners. Finish exposed fasteners same as flashing metal.

B. Self-Adhesive Flashing: 40 mils, nominal, thickness composite sheet, fabricated with 8-mil polyethylene film backing and 32-mil rubberized asphalt sheet waterproofing.

1. Acceptable Products: as follows, or equal, approved in accordance with Division 01, General Requirements, for substitutions.
   a. Perma-Barrier sheet by Grace Building Products, Cambridge, MA
   b. Carlisle Coatings and Waterproofing CCW-705T-WF
   c. Henry Company, Blueskin-TWF
   d. FortiFlash 40 Recessed Window Flashing by Fortifiber.
2. Furnish with prefabricated corner pieces, if available from sheet manufacturer.

C. Roofing Underlayment: ASTM D4601, asphalt saturated roofing felt, 25 or 28 pounds. per 100 square foot.

D. Metal Primer: For repair of Galvanized sheet metal, Zinc type, Galvilite by ZRC or equal.

E. Protective Backing Paint: Bituminous.

F. Sealant: Two-component, polyurethane-type specified in Section 07 92 00, Joint Sealers.

G. Solder: ASTM B32; 50/50 Type, Sn50, 50%tin/50%lead. flux type and alloy composition as required for use with metals to be soldered. Raw muriatic acid for galvanized steel; rosin for lead; non-corrosive soldering salts for uncoated copper and acid-type flux formulated for soldering stainless steel.

H. Rosin-Sized sheathing paper: Sealtight Red Rosin Paper by W.R. Meadows.

2.03 PREFABRICATED COMPONENTS

A. Reglets and Counterflashing: Surface-mounted or recessed as indicated on the drawings, galvanized steel, 24 gage reglet with 26 gage counterflashing, face and ends covered with plastic tape. SPRINGLOK; manufactured by Fry Reglet Corp., Alhambra, CA, or equal as approved in accordance with Division 01 for Substitutions.

2.04 FABRICATION

A. Form sections true to shape, accurate in size, square and free from distortion or defects. Fabricate all components per SMACNA standards unless more stringent conditions are imposed by the Roofing Contractor, in that case the more stringent conditions shall prevail.

B. Fabricate cleats and starter strips of same material as sheet, interlockable with sheet.

C. Form pieces in longest practical lengths.

D. Hem exposed edges on underside 1/2 inch; miter and seam corners.

E. Form material with flat lock seam.

F. Solder lap seams of all non-moving metal joints and seal other metal joints. After soldering, remove flux. Wipe and wash solder joints clean.

G. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.

H. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.

I. Fabricate flashings to allow toe to extend 2 inches over roofing. Return and break edges.

J. Provide expansion joints for gutters at every 30 feet. Fabricate per SMACNA details.

2.05 FINISH

A. Shop prepare and prime exposed ferrous metal surfaces.

B. Back paint concealed metal surfaces with protective backing paint when in contact with copper, redwood or red cedar.

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify roof openings, curbs, pipes, sleeves, ducts or vents through roof are solidly set, cant strips and reglets in place and nailing strips located.

B. Verify membrane termination and base flashings are in place, sealed and secure.

C. Beginning of installation means acceptance of existing conditions.

3.02 PREPARATION

A. Field measure site conditions prior to fabricating Work.

B. Install starter and edge strips and cleats before starting installation.

C. Install reglets true to lines and levels. For surface-mounted seal top of reglets with sealant.

D. Insert counterflashings into reglets to form tight fit. Seal flashings into reglets with sealant.

E. Secure flashings in place using concealed fasteners. Use exposed fasteners only in locations approved by Architect.

F. Lock and seal all joints.

G. Apply plastic-cement compound between metal flashings and felt flashings.

H. Fit flashings tight in place. Make corners square, surfaces true and straight in planes and lines accurate to profiles.

I. Seal metal joints watertight.

3.03 INSTALLATION

A. Parapet Copings and Flashings: Use 20 gage galvanized steel. Provide all copings and caps of the types and shapes indicated on the Drawings. Install Self-Adhesive Flashing under copings. Build in integral expansion joints allowing for movement of the metal without resulting in distortion of coping or leaks of any kind. All Work shall be watertight.

B. Fascias and Scuppers: Fabricate to detail of 20 gage galvanized sheet. Apply sealant in all crevices. Fabricate scuppers with 6 inch flanges.

C. Roof Flashings: Provide roof flashings as indicated in drawings and required to complete entire project. Submit shop drawings showing details for approval, use minimum of 24 gage galvanized steel.

D. Reglets and Counterflashings: Minimum 24 gage as detail in drawings, submit shop drawings.
   1. Reglets: For Surface-mounted and imbed applications.
   2. Counterflashings: Over bituminous base flashings.
   3. Counterflashings: Roof mounted mechanical equipment and vent stacks.
   4. Counterflashings: Roof Hatches and Skylights.

E. Roof Joint Cover Flashings: Provide roof joint covers as indicated in drawings. Submit shop drawings showing details for approval and use minimum of 24 gage galvanized steel. Fabricate tops slope to drain.

F. Gutters: Fabricate to detail of 20 gage galvanized sheet metal. Install an expansion joint every 30 linear feet of gutter; install cover plates over expansion joints. Fabricate gutter without longitudinal seams. Install cradles of 1/4 inch x 1-1/2 inch galvanized steel at 36 inch centers. Gutters shall rest in cradles, but shall not be mechanically fastened to allow for expansion and contraction.

G. Downspouts and Strainers: Downspouts shall be 24 gage galvanized steel. Strainers shall be 10 gage galvanized steel wire basket type. Provide all anchor clips and straps as required for installation. Install a wire basket strainer in all downspouts at gutter level. Rivet and solder flange of downspout to gutters per SMACNA details. Locate downspouts every 30 feet unless otherwise noted on drawing.

1. At steel pipe overflow-drain and interior drain pipe leaders install Downspout Nozzle #1770 by JR Smith, Montgomery, Alabama. Nickel bronze [polished bronze] with bird screen cast bronze body and flange. Refer to Drawings for pipe sizes and locations of drains and leaders. Minimum pipe size Schedule 40, 4 [6] inches.
2. Downspout Filter: FlowGard by KriStar Enterprises, Inc., Santa Rosa, CA. Model FG-DS4, 4" diameter, box size 14 x 29 x 7.5 inches, dual-wall geotextile fabric liner encapsulating absorbent, surfaced mounted unit. Locate at each pipe drain.

H. Conductor Heads: Provide conductor heads per SMACNA Figure 1-25, Design 1-25F unless Design Number noted otherwise; 24 gage Galvanized sheet metal.

I. Gravel Stops: Fabricate of 24 gage galvanized steel. Form true-to-line and detail as indicated. Provide formed corners locked and soldered full, with flashing flanges at least 4 inches under overlapping roofing materials and with aprons formed to straight lines. Install gravel stops in full bed of plastic cement and nail at 6 inch centers. All joints in gravel stops shall be butt type with back-up plates 12 inches long, of same gage and profile as the gravel stop. Wipe all exposed surfaces clean. Protect adjacent, exposed surfaces from plastic cement smears and stains.

J. Plumbing Vents - Vandal Proof: Provide pre-manufactured flashings and counterflashings for plumbing vent penetrations. Flashing, 4 lb lead, seamless, reinforced with steel boot, with 6" flange.

1. Counterflashing: cast iron Vandal Flash Hood with set screw to secure to pipe. Model 1100-5 Series by Elmdor/Stoneman, City of Industry, CA. Install per manufacturer's instructions.

K. Counterflashings for roof hatches and skylights: 24 gage sheet metal flashing, removable, per NRCA BUR/MB-14.

L. Interior Roof Drains: Provide 4 lbs lead, 30" x 30" flashing at single roof drains, 30" x 48" at drain and overflow drain unit.

1. Refer to drawings.

M. Roof Pipe Penetrations Flashings: Provide pre-manufactured flashings and counterflashings for pipe penetrations for electrical conduits, mechanical and plumbing lines. Flashing, 4lb lead, seamless, reinforced with steel boot, with 6" flange, field seal per Section 07 92 00.

1. Counterflashing: Single pipe penetration, cast iron ring with set screw to secure to pipe,. Model 1100-4 Series by Elmdor/Stoneman, City of Industry, CA. Install per manufacturer's instructions.
2. Counterflashing: Multiple pipe penetration, within single pre-manufactured flashing unit: Counterflashing PVC cap, adapter base and compression nut. Compression rings and gasket. Model 915 by Elmdor/Stoneman, City of Industry, CA. Install per manufacturer's instructions.

N. Door Drips: Provide door drips of 20 gage galvanized sheet metal at heads of all doors and windows in exterior walls where no roof or overhead protection occurs. Extend drips 2 inches beyond jambs, unless otherwise indicated.

O. Equipment Roof Curbs and Flashing: Fabricate equipment roof curbs with 20 gage galvanized steel, not less than 8" high, with 6" flanges, full welded construction. Provide curb flashings and counterflashings, 24 gage galvanized sheet metal fully soldered and mitered corners. Lengths, sizes, quantities, and location to completely flash roof equipment curbs.

P. Roof Penetrations: Equipment support stand penetrations; 8" high Flashing Collar flanged 6", overlapped 4" by Rain Collar, 24 gage components, secured with stainless steel drawband sealed top with polyurethane sealant. Stripping and roofing cement products per Roofing Section. Pitch pockets not permitted.

Q. Miscellaneous: Provide miscellaneous flashings as indicated in drawings and required to complete entire project, except for items provided under other Sections. Submit shop drawings showing details for approval and use minimum of 24 gage galvanized steel.

3.04 FINISH

A. Paint exposed metal flashings with high performance paints in accordance with Section 09 90 00, for Special Coatings.

END OF SECTION

SECTION 07 92 00

JOINT SEALERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Preparing substrate surfaces.

B. Sealant and joint backing.

1.02 REFERENCE

A. ASTM C790 - Use of Latex Sealing Compounds.

B. ASTM C804 - Use of Solvent Release Type Sealants.

C. ASTM C834 - Latex Sealing Compounds.

D. ASTM C881 – Epoxy-Resin Base Bonding Systems for Concrete.

E. ASTM C919 - Use of Sealants in Acoustical Applications.

F. ASTM C920 - Elastomeric Joint Sealants.

G. ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.

H. ASTM D1565 - Flexible Cellular Materials - Vinyl Chloride Polymers and Copolymers (Open-Cell Foam).

I. SWRI (Sealant, Waterproofing and Restoration Institute) - Sealant and Caulking Guide Specification.

1.03 SUBMITTALS

A. Product Data: Provide data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.

B. Manufacturer's installation Instructions: Indicate special procedures, surface preparation, and perimeter conditions requiring special attention.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Perform acoustical sealant application work in accordance with ASTM C919.

C. Prepare sample joints in the construction to demonstrate to the Architect the quality of the Work to be performed. Accepted sample joints will be used to judge the quality of the Work.

D. Qualifications
   1. Manufacturer: Company specializing in manufacturing the Products specified in this Section with minimum three years experience.
   2. Applicator:
      a. Pre-qualified applicator specializing in performing Work of this Section with minimum three years experience and approved by manufacturer.
      b. This applicator shall be licensed joint sealing specialty Contractor.
      c. Submit list of completed local projects of similar sealant applications.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.06 COORDINATION

A. Coordinate the Work with all Sections referencing this Section.

1.07 WARRANTY

A. Provide twenty-year product warranty submit under provisions of Division 1, General Requirements.

B. Provide five-year warranty for installers' submit under provisions of Division 1, General Requirements.

C. Warranty: Include coverage for installed sealants and accessories which fail to achieve air tight seal, water tight seal, exhibit loss of adhesion or cohesion, or do not cure.

D. Upon written notification of failure due to defective materials or application, repair or replace failure to the approval of the Architect and at no cost to Owner.

PART 2 - PRODUCTS

2.01 SEALANT AND MATERIAL MANUFACTURERS

A. Following is list of acceptable manufacturers of sealants and sealant materials. Inclusion in this list is not intended to imply that all manufacturers make all products. Products made by listed manufacturers must comply with all specified requirements.
   1. Tremco/Vulkem.
   2. Bostik Construction Products.
   3. Dow Corning Corporation.
   4. Sika Corporation.
   5. General Electric Company.
   6. W.R. Meadows, Inc.

7. Pecora Corporation.
8. Mameco International.
9. Sonneborn, ChemRex Inc.

B. Substitutions: Under provisions of Division 1, General Requirements.

2.02 SEALANT TYPES

A. Single-Component Urethane: ASTM C 920, Type S, Grade NS, Class 25, Use NT, A, M, and O; USDA and FDA status.

B. Single-Component Urethane (Self-Leveling): ASTM C 920, Type S, Grade P, Class 25, Use T, A, M.

C. Multi-Component Urethane (Gun-Grade): ASTM C 920, Type M, Grade NS, Class 25, Use NT, A, M, and O.

D. Multi-Component Polyurethane (Gun-Grade): ASTM C 920, Type M, Grade NS, Class 25, Use T, A, M, and O.

E. Multi-Component Urethane (Self-Leveling): ASTM C 920, Type M, Grade NS, Class 25, Use T, A, M, and O.

F. Single-Component Silicone (Non-Acid Cure): ASTM C 920, Type S, Grade NS, Class 25, Use NT, G, A, M, and O; USDA, NSF and FDA 21 CFR 177.2600 approved.

G. Acrylic-Latex Caulk: ASTM C 834.

H. Bedding Compound: For installation of thresholds and similar items indicated to be bedded in sealant, use a preformed butyl-polyisobutylene sealant tape. Size of tape as required for the specific application.

2.03 JOINT AND SURFACE TYPES

A. Non-Traffic Deck Joints - Provide one of the following for each joint type:
1. Multi-component urethane (gun-grade)
2. Single-component urethane

B. Vertical Joints - Provide one of the following for each joint type:
1. Multi-component polysulfide (non-sag)
2. Multi-component urethane (gun-grade)

C. Expansion, Control, and Perimeter Joints - Provide one of the following for each joint type:
1. Multi-component urethane (self-leveling)
2. Single-component urethane; use only where dynamic movement will not exceed 50 percent of joint width - above or below grade
3. Single-component urethane (self-leveling)

D. Non-Moving Joints, Interior and Exterior: Butyl rubber, ASTM C920.

E. Water-Immersion Areas - Provide one of the following for each joint type:
   1. Multi-component urethane (self-leveling)
   2. Single-component urethane (self-leveling)
   3. Multi-component polysulfide (self-leveling)
   4. Multi-component polysulfide (non-sag)

F. Acoustical Sealant - Provide one of the following for each joint type: ASTM C919.
   1. Acrylic-latex caulk
   2. Butyl rubber

G. Exterior Doors: Sealant used for exterior joints or butyl rubber.

H. Interior Doors - Provide one of the following for each joint type:
   1. Acrylic-latex caulk
   2. Butyl rubber

I. Miscellaneous locations: Butyl rubber at all gaps, holes, openings, under wood sills or channel metal track in exterior envelope of building not identified herein. Install as directed by the Architect.

2.04 SEALANT COLORS

A. Provide materials matching colors indicated or if no color is indicated, matching the color samples selected from those submitted to the Architect.

2.05 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Joint Backing: Round, closed cell polyethylene or butyl rubber backer rod; oversized 30 to 50 percent larger than joint width.

D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces and joint openings are ready to receive Work.

B. Verify that joint backing and release tapes are compatible with sealant.

3.02 PREPARATION

A. Remove loose materials and foreign matter which might impair adhesion of sealant.

B. Clean and prime joints in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions.

D. Protect elements surrounding the Work of this Section from damage or disfiguration.

3.03 INSTALLATION

A. Do not proceed with sealant Work until the sample joints specified in Part 1 of this Section have been prepared and accepted by the Architect.

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

C. Measure joint dimensions and size materials to achieve required 2:1 width/depth ratios.

D. Install joint backing to achieve a neck dimension no greater than 1/3 of the joint width.

E. Install bond breaker where joint backing is not used.

F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

G. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

H. Tool joints concave unless detailed otherwise.

3.04 CLEANING

A. Clean adjacent soiled surfaces.

3.05 PROTECTION OF FINISHED WORK

A. Protect finished installation under provisions of Division 1, General Requirements.

B. Protect sealants until cured.

END OF SECTION

SECTION 08 12 13

HOLLOW METAL DOORS/FRAMES

PART 1 - GENERAL

1.01 Work Under This Section

A. Comprises Of Furnishing And Installing Hollow Metal Frames For Doors, And Hollow Metal Doors And Panels.

B. Related Documents, drawings and general provisions of contract, including General and Supplementary conditions and Division 01 specification sections apply to this section.

C. Related Work Sections
   1. Section 08 71 00 Finish Hardware
   2. Section 09 90 00 Painting

1.02 REFERENCES SPECIFIED

A. ISO 9001 – Quality System.

B. A1008/A1008A Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

C. ASTM-A568 – General Requirements for Steel, Carbon and High Strength Low AlloyHot Rolled Strip, and Cold Rolled Sheet.

D. ASTM-A924 -General Requirements for Steel Sheet, Metallic Coated by the Hot-Dip Process.

E. ANSI A250.8/SDI-100 - Recommended Specifications for Standard Steel Doors and Frames.

F. ANSI 250.11 - Recommended Erection Instructions for Steel Frames.

G. SDI-107 - Hardware on Steel Doors (Reinforcement Application).

H. NFPA-101 - Life Safety Code.

I. ANSI-A250.4 and ANSI-A250.5 -Test Procedure and Acceptance Criteria for Physical Endurance, Steel Doors and Frames.

J. ANSI-A250.10 - Test Procedure and Acceptance Criteria for Painted Steel Surfaces for Steel Doors and Frames.

K. ADA-The Americans with Disabilities Act - Title III - Public Accommodations.

L. ANSI-A117.1 - American National Standards Institute - Accessible and Usable Buildings and Facilities.

M. CBC - California Building Code and Local Codes Including Authority Having Jurisdiction.

N. 1784 Air leakage test of door assemblies.

O. 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.

1.03 SUBMITTALS

A. Shop Drawings: Indicate door and frame elevations and sections, materials, gauges, finishes, fabrication and erection details, location and extent of hardware reinforcement, type and location of frame anchors, locations of finish hardware by dimension and locations/details of all openings and louvers. Do not proceed with any fabrication until all details are approved.

B. Certification of Compliance: Submit any information necessary to indicate compliance to these specifications.

C. Submit samples if requested by the Architect.

D. Job Close-out: Provide 2 (two) complete Manufacturer's catalog's to the District Lockshop and Facilities.

1.04 QUALITY ASSURANCE

A. All hollow metal doors and frames shall be the product of one (1) manufacturer.

B. Exceptions will not be permitted under any circumstances.

C. Hollow metal manufacture shall be a SDI member.

D. The Hollow Metal Manufacturer shall supply doors and frames through a national distribution system as described in 1.06.D herein. Marketing material through a factory direct method will not be acceptable to the Building Owner.

E. Hollow metal supplier shall be a qualified "local direct distributor" of products to be furnished. The distributor shall have in their regular employment an AHC and/or CDC with a local business address, telephone and fax line, who will be available at reasonable times throughout the project, to consult with the Architect, Contractor and District regarding matters affecting the door and frame openings.

F. The Contractor will allow in his bid for the replacement of one (1) exterior door each site which will be selected at random by the Project Architect and District's Rep. for dismantling and inspection of internal construction and compliance with the specification. Contractor to provide labor and tools for inspection under the Architect's direction.

G. Failure of any hollow metal frame or door to meet specified standards shall be grounds to reject the entire shipment of hollow metal doors and frames, including the hollow metal manufacturer. Items shall be replaced at Contractor's expense, including two additional doors for dismantling. No extensions of time or additions to the contract will be allowed due to a rejection of material and substitution of the hollow metal manufacturer.

H. Installer requirement: Firm with a minimum of five (5) years experience in the installation of metal doors and frames similar in the type included in this specification.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver doors and frames cardboard wrapped, crated, palletized or otherwise protected during transit and site storage.

B. Inspect doors and frames upon delivery for damage. Minor damages may be repaired provided refinished items are equal in all respects to new work and accepted by the Architect. Otherwise remove and replace damaged items.

C. Store doors and frames at the building site in a dry, secure place.
   1. Place units on minimum 4 inch high wood blocking.
   2. Avoid non-vented shelters [covering] that can create a humidity chamber.
   3. If cardboard wrapper on door becomes wet, remove carton immediately.
   4. Provide 1/4-inch spaces between stacked doors to promote air circulation.

1.06 SEQUENCING AND SCHEDULING

A. Deliver all doors and frames to the job site in a timely manner so not to delay progress of other trades.

B. Issue purchase orders to frame, door and hardware suppliers in sufficient time so as not to interfere with normal quoted delivery of materials.

1.07 WARRANTY

A. Hollow metal doors and frames shall be supplied with a one (1) year warranty against defects in materials and workmanship.

B. Warranty to commence with substantial completion of the job.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturers:
   1. Curries, Division of AADG, Inc.
   2. Or Equal, provided products meet the specified performance and construction requirements, and are acceptable to the District. Such products are subject to California Public Contracts Code Section 3400.

B. Performance criteria as specified in 2.03 will be supported by an independent laboratory cycle and twist test certification document, and will be included in supplier's shop submittals. Any proposed substitution will be reviewed by the District Facilities Supervisor. Requests will include a list of (20) recent institutional installations, date of installation, and the current contact names and facilities telephone number. Additionally, any requests will include a full size door and corner sample containing design and construction requirements as contained in this specification.

2.02 MATERIALS

A. Steel requirements, all doors and frames to be manufactured of commercial quality, stretcher leveled flatness, cold rolled steel per ASTM-A1008 and A-568 general requirements or galv. to A60 minimum coating weight standard per ASTM-A924 or A653 hot dip galvanized to A60 minimum coating weight standard. Internal reinforcing may be manufactured of hot rolled pickled and oiled steel per ASTM-A1011.

B. Coating Materials Primer: all doors and frames to be bonderized and finished as standard with manufacturer's baked-on primer conforming to ANSI-A259.10.

C. Door Core
   1. Polystyrene core. All doors to have:
      a. Non-labeled or labeled doors: polystyrene slab [minimum .24 U Factor], self extinguishing, non-toxic in case of fire.
      b. Permanently bonded to the inside of each face sheet providing rigidity, insulating and sound deadening properties to the door.
      c. Refer to 2.03 for additional specification.
      d. **Steel ribbed doors are not acceptable in the SBCUSD.**
   2. Temperature rise rated doors should be provided for stairwell enclosures which indicate "Temperature rise 30 minutes - 450 degrees F maximum or 250 degrees F maximum" as required by the local building code.

2.03 FABRICATION

A. General
   1. Fabricate all doors and frames in accordance with ANSI A250.8-1998/SDI-100 except where more stringent requirements are specified.
   2. As detailed on plans, fabricated "welded" frame units to be delivered to job site as single units. Transoms, sidelights, and window walls which are "oversize" for transportation and installation, shall be furnished with field splices to be field assembled by the general contractor.
   3. Supply only doors and frames manufactured by the acceptable manufacturer listed in this specification
   4. Doors to be 707 Series as Manufactured by the Curries Co, Mason City, IA.
   5. Prepare doors to receive door hardware per approved schedule, including internal reinforcing. Through-Bolts (SNB) are not permitted unless specifically requested by the Architect and/or District. Do not include unnecessary cutouts in door faces not required by hardware template.

B. Door Construction
   1. Classification: SDI Level III - Model 2 (16GA. doors).
   2. Face sheets formed of cold rolled steel.
   3. Exterior doors to be galvanized to A60 minimum weight standard.
   4. Seamless construction [Equal to Curries 707T] by continuous wire weld of both edges full height of door, and to be done at the factory.

5. On louver doors, perimeter channel reinforcement at louver cutouts to be sealed watertight.
6. Lock edges beveled 1/8 inch in 2 inches.
7. Door lock edge reinforcing shall be one-piece, full height 14GA. Channel. Door hinge edge reinforcing shall be one-piece, full height 12GA. Channel formed and tapped for hinges or as required per listed hardware.
8. Both hinge and lock channels to be welded to each face sheet of the door.
9. Top and bottom channels:
   a. Not less than 16GA. - flush or inverted.
   b. Welded to the face sheet.
   c. Close tops of exterior doors flush by the addition of 16GA. Galvanized. steel channel fillers. Channel filler to sealed watertight.
10. Astragals: Where called for to be flat security type or 'Z' as called for in drawings or specifications.
11. All doors to conform to A.N.S.I.-A 250.4 Test Procedure and Acceptance Criteria for Physical Endurance. Door size cycle tested to be 4070 to minimum Level A performance for 18 or 16GA. door. Furthermore, doors will have been subjected to an additional one (1) million cycle and twist tests with a combined two (2) million cycles and 46 twist tests. Tests will have been conducted by an independent lab. Certification of this criteria to be submitted with approval drawings by the distributor. Exceptions will not be considered.
12. Transom Panels: To be constructed similar to doors.
13. Where indicated, provide insert type louvers in bottom of doors. Louvers to be not less than 18 gauge prime coated steel.

C. Door Frame Construction
1. Frames shall comply with ANSI/SDI A250-5 Level A, one million cycle swing test performance for a 4070 door frame.
2. All frames to be formed from cold rolled steel. Furnish 14GA. exterior door and window frames and 16GA. interior door and window frames. Both exterior door and window frames to be galvanized to A60 minimum weight standard.
3. All frames are to be Full Profile Welded, ground smooth, and re-primed at the welded area.
4. Provide temporary shipping bars to help protect from damage during transit and handling.
5. Temporary shipping bars to be removed before setting frames.
6. All welds on frames, transoms and sidelites to be flush with neatly mitered or butted material cuts.
7. Water Penetration: Borrowed lite assemblies, transom, sidelite, and combination transom sidelite frames are not factory sealed to prevent water penetration. In situations where water penetration is a concern, the Contractor must seal all joints that are exposed to the elements after the frame assembly is installed.
8. Whenever possible, it is strongly recommended that glass and glazing be installed on the exterior rabbet of the frame assembly. This will help act as a deterrent to water penetration.

9. The member companies of the hollow metal industry can not control the workmanship associated with the frame installation; therefore, it is the responsibility of the installer to assure all steps are taken to prevent water penetration.

D. Frame Anchors: Provide sufficient anchorage to attach to wall in accordance with ANSI/SDI A250.5 Test Compliance Level A of one million cycles, or anchorage as detailed on plans to specific wall conditions.

1. All frame jamb anchors to be provided: one each jamb per 24 inches of frame height or fraction thereof. Furnish a minimum of two head anchors for frames installed in stud walls and three or more anchors in frame width exceeding 42".
2. Floor anchors - angle clip type:
   a. Minimum 16GA.
   b. To receive 2 fasteners per jamb.
   c. Welded to the bottom of each jamb.

E. Hardware Preparation

1. Reinforcements: reinforce components for hardware installation in accord with ANSI-A115. Provide minimum gage hardware reinforcing for mortise or surface applied hardware as follows:

a.	Hinge	- 10GA. or equivalent number of threads on doors.
b.	Hinge	- 7GA. on frames for mortise butt hinges.
		- 12GA. full length on frames for continuous hinges.
c.	Lock	- 12GA. or equivalent number of threads.
d.	Panic Devices	- 12GA.
e.	Surface Closer	- 12GA.
f.	Hold Open Arm	- 12GA.

   Field drilling and/or tapping for surface applied hardware is installation Contractor's responsibility.

   g. Additional Door Related Reinforcements:
      1. Lock reinforcement shall be 16GA. Channel type typical of Curries G2B [161] and G3 [86] four sided compression resistant design.
      2. Panic reinforcement to be 14GA. channel type.
      3. Closer reinforcement to be 12GA. Channel type.
      4. Hinge and lock reinforcing on doors to be channel type, continuous from top to bottom of door welded to face sheets.

2. Punch single leaf frames to receive three (3) silencers. Double leaf frames to receive one silencer per leaf at head.
   a. Factory prepared hardware locations to be in accord with "Recommended Locations for Builders' Hardware for Standard Steel Doors and Frames", as adopted by The Steel Door Institute.
   b. Supply welded in mortar guards at all hardware cutouts in frames built into masonry or grouted in full.

F. Excess Material

1. Contractor to deliver any unused doors and frames to the District's designated Representative. Review with District.

G. Existing Construction **[MODERNIZATION WORK]**

1. Contractor is responsible for **field survey** of existing doors and/or frames to determine compatibility of specified hinges, locksets, exit devices, trim, strikes, closers, overhead stops, flushbolts, coordinators and hinge sizes/weights as listed in the specification.
   a. Regardless of the Architect's plans and door/frame schedule, the required field survey will include the field measurement of each opening specified to receive a replacement door and/or frame, to determine door/jamb/header dimensions, and opening jamb depths.
   b. The Contractor will submit a compiled list of respective door and frame measurements to the Project Architect for consideration, review and approval before any door and frame is ordered. Coordination with the door and frame supplier's is mandatory.
   c. The Door and frame supplier will be available to the contractor for consultation and technical assistance.
2. Existing doors and/or frames to be modified for all items of hardware specified, including necessary hardware reinforcements.
3. Existing frames with new doors to be templated with lockset latchbolt aligned with existing frame strike. Where 4-7/8 ASA strikes are required in frames with less thannecessary dimensions, Contractor will field cut existing strike jambs, remove the existing strikes, then weld reinforced strike prep to accept the required 4-7/8 ASA strike. Surface installation is prohibited.
4. Contractor will fill, patch, sand and repaint doors and/or frames affected by the removal of existing hardware and the installation of replacement hardware. In addition, whether listed or not, Contractor shall be responsible for furnishing fillers for removed hinges, locksets, strikes, closers, panics, door stops and etc.
5. If the respective doors and/or frames are considered unsuitable for reuse, and/or do not correspond to the hardware specification, the Architect and/or Building Owner's Representative will be notified immediately in order to address the issue at the earliest opportunity.

PART 3 - EXECUTION

3.01 FRAME INSTALLATION

A. Erection Installation: Install hollow metal units in accordance with manufacturer's instructions and final shop drawings. Fit doors to frames and floors with proper clearances and to achieve the maximum operational effectiveness and appearance of each unit. SDI 122-99 "Installation and Trouble Shooting Guide for Standard Steel

B. Doors and Frames" or "The Installation of Commercial Steel Doors and Steel Frames" as published by DHI are recommended guidelines.

C. Set welded frames in position prior to beginning partition work. Brace frames until permanent anchors are set.

D. Set anchors for frames as work progresses. Install anchors at hinge and strike levels.

E. Use temporary setting spreaders at all locations. Use intermediate spreaders to assure proper door clearances and header braces for grouted frames.

F. Install frames in prepared openings in concrete and masonry walls using countersunk bolts and expansion anchors.

G. Where frames require ceiling struts or other structural overhead bracing, they shall be Anchored securely to structure above, as required.

H. Frames shall be filled solid with Portland cement grout where shown or required by class 6 opening in masonry or concrete walls. Provide steel plaster guards or mortar boxes, welded to frame, at back of hardware cutouts where installed in concrete, masonry or plaster openings. Protect inside throat of each frame in grout filled wall conditions or where antifreeze additives are used in fill, with a waterproof undercoating type material minimum 1/8 inch thick, field applied by installer.

3.02 DOOR INSTALLATION

A. Install hollow metal doors in frames using hardware specified in Section 08 71 00 Finish Hardware. Doors are to be expertly hung and shall fit snug against all stops. Doors Shall fit accurately and hang free from hinge bind with a uniform clearance of 1/8 inch at head and jambs. After hanging, make all adjustments and then remove respective hardware for finish painting. Reinstall hardware after finish painting.

B. Maximum clearances at edge of doors:
   1. Between door and frame at head and jambs: 1/8 inch.
   2. At meeting edges pairs of doors and at mullions: 1/8 inch.
   3. At transom panels, without transom bars: 1/8 inch.
   4. At sills without thresholds: 5/8 inch max above finish floor.
   5. At sills with thresholds: 1/8 inch above threshold.

C. Hardware Installation: to be installed securely without marking or defacing hardware or Finish work. Protect finish hardware with suitable protective covering until completion of building. Leave all hardware in perfect working order. Clean and polish.

3.03 FINISH

A. Paint frames and doors under Section 09 90 00.
   1. Colors: As selected by Architect.

3.04 ADJUSTMENT AND CLEANING

A. Remove dirt and excess sealant, mortar or glazing compounds from exposed surfaces.

B. Adjust for smooth operation as required. Install shims as required to allow for proper closing.

C. Fill all dents, holes, etc. with metal filler and sand smooth and flush with adjacent surfaces - reprime/paint to match finish.

END OF SECTION

SECTION 08710

DOOR HARDWARE

PART 1: GENERAL

1.01 SUMMARY

A. SECTION INCLUDES:

1. Work under this section comprises the furnishing and installation of hardware specified herein and noted on drawings for a complete and operational system, including any electrified hardware components, systems and controls.
2. Related Documents, drawings and general provisions of contract, including General and Supplementary Conditions, and Division 1.
3. Items include but are not limited to the following:
   a. Hinges
   b. Exit Devices
   c. Locksets
   d. Cylinders
   e. Push/Pull Plates
   f. Automatic Flush Bolts
   g. Closers
   h. Kick, Mop and Protection Plates
   i. Stops and Overhead Controls
   j. Thresholds, Gasket and Door Bottoms
   k. Miscellaneous Accessories and Trim

B. RELATED WORK:

Section 08210 - Wood Doors
Section 06200 - Finish Carpentry.
Section 08110 - Hollow Metal Work.
Sections within 08800 - Glazing.
Sections within 09900 - Painting.
Electrical Division 16.

1.02 SUBSTITUTIONS

A. References to specific products are used to establish minimum standards of utility and quality. Unless otherwise approved, furnish only the specified products.

B. Requests for substitutions to be in accordance with Division 1, General Requirements. Proposed substitutions must be submitted in writing and hand delivered to the Architect. Approvals must be by addendum ten [10] days prior to bid opening. Building Service's Director will be notified of any requests.

C. All requests to be accompanied by two [2] copies of the manufacturer's brochures and a physical sample of each item in the appropriate design and finish. Items listed with no substitute have been requested by the Building Owner to match existing building standards.

E. Should the Contractor make any substitutions without the written consent of the Architect, Contractor shall remove all substituted hardware, replacing same with the hardware as specified and at no additional cost to the Building Owner.

1.03 REFERENCES

A. References specified in this section subject to compliance as directed and shall meet requirements of Federal, State and local codes having jurisdiction over including:
1. CCR - California Code of Regulations Title 24.
2. ADA - American Disabilities Ac
3. NFPA 80 - Standard for Fire Doors and Windows.
4. NFPA 101 - Life Safety.
5. ITS - Intertek Testing Service [Warnock Hersey].
6. UL - Underwriters Laboratories.
7. ANSI/BHMA A156 Product Listing.
8. CBC Building Code, State Codes and Authority Having Jurisdiction.
9. UL 10C for Positive Pressure Fire Tests of Door Assemblies and UBC 7-2.

B. Hardware that is furnished and/or installed that does not meet code requirements, shall be removed and replaced with correct material at no additional expense to the Building Owner.

1.04 QUALITY ASSURANCE

A. PRODUCT UNIFORMITY: Except where specified, all hinges, keyed cylinders, electro-mechanical components, locksets, latchsets, exit devices, closers, overhead one manufacturer shall furnish stop/holders and component parts.

B. RATED OPENINGS: Hardware used in labeled fire or smoke rated openings to be listed for those types of openings and bear the identifying label or mark indicating U.L. [Underwriter's Laboratories] approved for fire. Exit devices in non-labeled openings to be listed for panic.

C. SUPPLIER: Shall be responsible for detailing hardware that meets project standards and where appropriate, retrofit applications, which require inspection of openings prior to detailing and ordering respective hardware items.

D. PRE-INSTALLATION CONFERENCE: Prior to installation of hardware, arrange a conference between supplier, installers, and related trades to review materials, procedures, hardware mounting locations and related work.

E. INSTALLATION EXERCISE: Contractor/Installer is required to install one complete exterior opening Hardware Set and the respective hollow metal door and frame to establish both know-ledge and skill as required for this project. Door/frame and hardware installation practice will be coordinated with the Project Architect and Building Owner's Representative, and shall be accomplished to the PA's satisfaction, and prior to the installation of any doors/frames and door hardware. Typical hardware set to be comprised of hinges, panic device, trim, door closer, overhead stop if detailed, flat goods, threshold, sweep, drip cap and perimeter seal or as directed by the Architect. Damage resulting in replacement material or repair, including labor, shall be absorbed by the Contractor/Installer.

F. POST-INSTALLATION POLICING: Will be required by the Hardware Supplier, Contractor and Architect to determine compliance with the hardware specification and building standards.

G. SUPPLIER QUALIFICATIONS:

1. Hardware supplier must be a recognized, Southern California based FACTORY DIRECT contract distributor with a minimum five (5) years experience specializing in institutional grade builders hardware of the type specified herein. Distributors with less than two (2) years of history of furnishing builders hardware in the project's vicinity will not be acceptable.
2. Supplier must have in his/her employment on a full time basis, a Certified Hardware Consultant [AHC] or person of equal experience who is acceptable to the Architect and CM. This individual shall be available for consultation and service to the architect, contractor, and building owner during construction and on an ongoing consulting service to the building owner following the completion of the project.
3. Supplier who does not maintain personnel in a permanent facility within a reasonable driving radius of the project area for consultation and service with the Architect, Contractor and Building Owner will not be acceptable.

1.05 GENERAL REQUIREMENTS

A. COORDINATION: Coordinate as necessary with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

B. SEQUENCING AND SCHEDULING: Any part of the finish hardware required by the frame or door manufacturers or other suppliers, that is needed in order to produce doors or frames is to be sent to those suppliers in a timely manner.

C. DEFECTIVE HARDWARE: All hardware shall be new and free from defects affecting both serviceability and appearance. Working parts shall be properly fitted, smooth working and without excessive play.

D. FUNCTION/MODIFICATION:

1. Should any hardware fail to meet the intended operational requirements or require any modification to suit the intended location, this matter, or any other necessary advance information, shall be brought to the attention of the architect for correction or advice in ample time to avoid delay in the manufacture and delivery of the hardware.
2. Modifications to specified hardware, required by reason of construction characteristics, shall be furnished in the specified operational, functional features, quality and finish. Modifications shall be subject to acceptance of the Architect at no additional cost to the Building Owner.
3. Items of hardware not specified herein but necessary for completion of the work shall be furnished at no additional cost to the Owner. Such items shall be of the type specified and comparable to adjacent hardware.

E. DOORS AND FRAMES: Hollow metal and wood doors shall be manufactured to templates. If required, physical hardware items shall be furnished to related manufacturers in sufficient time to avoid delay in work.

F. Contractor/Installer will deliver all unused finish hardware to the District Lockshop.

G. EXISTING [MODERNIZATION – EACH SITE]

Contractor is responsible for a field survey of doors, frames and hardware to determine compatibility of specified hardware, including, but not limited to: locksets, panic devices, strikes, automatic flushbolts, overhead stops, coordinators, closers, threshold/seal, hinge sizes and weights including wide throw hinges needed to achieve maximum door swing at exterior doors. With the exception of mechanical/storage/single occupancy restrooms, furnish overhead stop control [CPS/CPSH] only where conditions require overhead stop control.

Unless directed otherwise, contractor to modify openings to meet ADA elevation threshold requirements. Contractor to survey and where necessary, furnish and install ADA approved threshold systems where applicable and approved by the architect. Work shall comply with minimum ADA specifications as well as create a flat sub-surface for specified thresholds.

Existing doors and frames to be modified for hardware as permitted by UL, WHI and local code authority. Where required, Contractor shall cut and weld necessary reinforcements to existing jambs and doors, for listed hardware as applicable and required. Contractor to patch sand and repaint/refinish reused door and frame surfaces affected by the removal of hdwe, and modification for replacement hdwe.

Whether listed or not, Contractor shall furnish frame/door hinge, strike, lock face, panic, closer and overhead auxiliary stop fillers where required for a clean finished appearance. Related costs to field modify existing frames and/doors shall be part of the Contractor's base bid and shall include a $500.00 allowance for door and frame fillers. Intertek Testing Service inspection and certification is required for the labeling of non-rated doors and frames, and the modification of any labeled door and frame. Contractor is responsible for contacting and coordinating this required labeling service. Contractor is responsible for the careful removal, treatment and delivery of all existing replaced and any unused new hardware to the Building Service's Director.

1.06 SUBMITTALS

A. HARDWARE SCHEDULE: Submit typewritten copies of schedule in accordance with Division 1, General Requirements. Schedule to be in VERTICAL format, listing each door opening including; location, handing of opening, all hardware scheduled for each opening or otherwise required to allow for proper function of door opening as intended, finish of hardware, and respective manufacturers. Doors with closers or door controls shall require the degree of door opening.

1. Supply six [6] copies of the schedules within fifteen [15] working days from date of purchase order.
   a. The hardware schedule shall conform to DHI's: Recommended Procedure for Processing Hardware Schedules and Templates."
   b. Submit manufacturer's catalog cut sheets of all hardware items scheduled and any special mounting instructions with the hardware schedule.
   c. Include recommended mounting location data for each type of scheduled door hardware. Include electrified hdwe w/applicable.
2. No hardware item shall be delivered until the hardware schedule has been approved by the Project Architect.
3. Approval of the hardware schedule by the Architect does not relieve the hardware supplier from the responsibility of furnishing the job complete.

B. SAMPLES:

1. If directed by the Architect, submit physical samples of each item of hardware proposed in work.
2. Samples will be returned on the request of and expense of the Contractor.

C. MFR'S CATALOG ILLUSTRATIONS AND HARDWARE DATA:

1. Submit, to the Architect, two [2] catalog cuts of every item of hardware furnished for this project. Data shall be contained in a binder appropriately divided by the respective manufacturers.
2. Cuts shall include manufacturer's illustrations and shall identify finishes, sizes and product numbers. Abbreviations to be fully explained.

D. OPERATIONAL DATA:
   1. Deliver to the District, through the Architect,
      a. One [1] set of factory catalogues for hardware listed in the approved hardware list.
      b. One [1] copy of approved door hardware shop drawings.
      c. One [1] copy of door hardware specifications.

E. TEMPLATES: Templates for door hardware items to be sent to related door and frame suppliers within three [3] working days of receipt of approved hardware schedule. Templates shall not be issued until the door hardware schedule has been reviewed and approved by the Project Architect.

F. CERTIFICATION OF COMPLIANCE: Submit any information necessary to indicate compliance to any or all of these specifications as required.

G. KEYING SCHEDULE:
   1. Submit three [3] copies of a separate detailed keying schedule to the Contractor.
   2. Indicate keying of all cylinders, exit devices, locksets, and padlocks. Include door & item numbers as set forth in the approved hdwe schedule.
   3. Keying data shall follow "Keying Systems and Nomenclature" as established by DHI.
   4. Prior to placing a factory order, the key schedule shall be approved in writing by the S.B.C.U.S.D Building Services management.
   5. Arrange with S.B.C.U.S.D Building Services for the handling of the District's key bitting list. Copy of the list must be sent to Sargent's Key Record's Department.

1.07 DELIVERY, STORAGE AND HANDLING

A. PACKAGING: Each unit of hardware shall be individually packaged in the manufacturer's original containers as required by the respective hardware manufacturers.
   1. Packaging shall include factory original installation instructions, fastenings and all items necessary for complete installation.

B. WRAPPING: Wrap and cushion each item to prevent scratches and dents during delivery and storage.

C. ENVIRONMENTAL PACKAGING: Hardware shipped to the jobsite is to be packaged in biodegradable packs, such as paper or cardboard boxes and wrapping. If non-biodegradable packing is utilized, such as plastic, plastic bags or styrofoam, then the Contractor will be responsible for the disposal of the non-biodegradable packing to a licensed or authorized collector for recycling of the material.

D. MARKINGS: Each package shall be clearly marked on the outside, identifying contents with specific opening number corresponding to those listed in the hardware schedule. Include door and item number for each product.

E. DELIVERY: Except as dictated otherwise, deliver all hardware to the job site. The Contractor and Hardware Supplier's Representative shall check each item of hardware against the approved finish hardware schedule.

F. STORAGE: All hardware shall be stored in a locked storage space until ready for installation. Hardware shall be protected against damage after application and during construction period.

1.08 WARRANTY

A. All door hardware shall be supplied with a one [1] year warranty against defects in materials and workmanship, commencing with substantial completion of job.

PART 2: PRODUCT:

2.01 MANUFACTURERS

A. ACCEPTABLE MANUFACTURERS:
1. All materials or products specified herein shall be furnished AS SPECIFIED. Refer to Para. 1.02 SUBSTITUTIONS.
2. Any substitution request must be evaluated and approved by S.B.C.U.S.D Building Services management personnel.
3. Following are approved manufacturers which comprise the base bid:

PRODUCT	SPECIFIED MFRS	APPROVED MFRS
Hinge	McKinney	Hager, Stanley
Lockset Marks	Sargent FW10L	
Exit Device	Sargent	as Specified
Cylinder/Keying	Sargent	as Specified
Closer	Sargent	as Specified
Anti-Vandal Pull	Trimco	Sargent
Push/Pull/KP	Trimco	McKinney
O.H. Stop	Sargent	as Specified
Door Stop	Trimco	McKinney
Thresh/Seal	Pemko	McKinney, Reese

2.02 FASTENINGS

A. Furnish hardware with all necessary screws, bolts or other fastenings of suitable type and size to anchor the hardware in position for long life and heavy use. Fasteners shall include expansion shields, sex bolts, toggle bolts, or other approved anchors according to material to which it is applied and as recommended.
   1. Furnish Phillips flat-head screws except as otherwise indicated.
   2. Thru-bolts shall be furnished for closers panic and overhead stops per district standard. Doors/frames are shall be reinforced per Curries HM.
   3. Hdwe applied to concrete shall be installed with RED-HED anchors.
   4. Self-tapping screws are not permitted in S.B.C.U.S.D work.

B. Design of all fastenings shall harmonize with hardware as to material and finish.

2.03 HINGES

A. All hinges and pivots, including single and double acting types, pocket hinges, electric hinges and continuous aluminum geared hinges to be of one manufacturer as listed for continuity and consideration of warranty.

B. Unless otherwise specified, furnish five-knuckle exposed tip as specified; full mortise template type hinges with non-rising loose pins.

C. Out-swinging exterior doors to be furnished with anchor hinges of stainless steel or solid bronze with non-removable pins [NRP].

D. Interior doors to be furnished with wrought steel polished and plated to match specified finish.

E. Furnish three [3] hinges up to 90 inches high and one [1] additional hinge for every 30 inches or fraction thereof.

F. Furnish standard weight hinges on doors up to 36 inches in width, and extra heavy weight on doors exceeding 36", or as indicated in the hardware schedule.

G. Furnish 4.5 x 4.5 inch for all 1-3/4 inch thick doors up to 36 inch wide, and 5 x 4.5 over 36 inch wide. Doors over 1-3/4 inch thru 2-1/4 inch thick, use 5 x 5 inch hinges.

H. Where required, furnish hinges of sufficient width to clear trim and/or permit the door to swing 180 degrees as required by the specific opening.

I. Furnish oil-impregnated bearing hinges at all doors.

2.03A CONTINUOUS HINGES

A. Hinge line to be available in concealed flush mount with or without inset, full surface and half surface types as specified in the hardware sets. Furnish wide throw hinges as required to clear trim permitting doors to open 180 degrees.

B. All hinges to be made of extruded 6063-T6 aluminum alloy with thrust bearings.

C. All continuous hinges to be fire-rated 20, 45 and 90 minutes when incorporated into proper door and frame labeled installations, without necessitating the use of fusible link pins.

D. All hinges to be available in standard, heavy and extra heavy-duty weight. All mortise and wide throw as specified in the hardware sets.

E. Exterior new openings: furnish MCK-12HDWT [wide throw] where conditions dictate to achieve maximum door swing, and MCK-54HD half-surface at new doors with existing frames, and MCK-22HD full surface at existing doors/frames where required. Contractor is responsible for a building/opening survey to determine wide throw hinge requirements.

F. All hinges to be factory cut for door size.

2.04 MORTISE LOCKS

A. All mortise locksets, panic, trim and cylinders to be of one manufacturer as listed for continuity of design and consideration of warranty.

B. Locksets shall be Sargent 8200 Series x LNL trim [WTL where dictated at existing escutcheon templating only]. Where WTL is used involving multiple doors, furnish same trim for continuity. Review with SBCUSD Building Services.

C. All lockset functions shall be manufactured in a single sized case formed from 12 gauge steel minimum. The case shall be closed on all sides and back. The lockset shall have a field-adjustable, beveled armored front, with a .125 inch thickness minimum. The lockset shall be 2 3/4 inch backset standard, with a one-piece 3/4 inch throw anti-friction stainless steel latchbolt. The deadbolt shall be a full one inch throw made of stainless steel and have 2 hardened steel roller inserts.

D. Lever return springs shall be internal. Springs used for leveling and lever return shall not be located outside of the lock case. Return springs shall not be located in the exterior rose or trim.

E. Full lever retraction at only 30 degrees for ADA accommodation.

F. Handing shall be field reversible without opening the lock case.

G. Mortise locksets for labeled fire doors shall have a fusible link mechanism to prevent latchbolt retraction in case of fire.

H. Provide curve lip strikes with wrought boxes for all locks. Strikes shall be of sufficient length to protect trim or the inactive leaf of a pair of doors.

2.05 CYLINDRICAL LOCKS

A. All cylindrical locks to be of one manufacturer as hereafter listed for continuity of design and consideration of warranty.

B. Locksets shall be Mark's 195 Survivor Series with 2-3/4" backset.

C. Locksets and latches shall be heavy-duty cylindrical type Grade 1. Latchbolts shall have minimum of ½ inch projection.

D. Lock and latchsets shall be constructed with thru-bolted design and independent spring cartridge system for lever stability and operation.

E. Provide 4-7/8" curve lip strikes with wrought boxes. Strikes shall be of sufficient length to protect trim or the inactive leaf of a pair of doors.

2.06 EXIT DEVICES

A. All exit devices, lever trim, and cylinders to be of one manufacturer as listed and in the hardware sets for continuity of design and consideration of warranty.

B. Exit devices shall be Sargent 80 Series at new construction x Trimco 1097HA trim, and as listed.

C. Sargent 30 Series exit devices required as listed.

D. Exit devices to be "UL" listed for life safety. All exit devices for labeled doors shall have "UL" label for "Fire Exit Hardware." All devices mounted on labeled wood doors are to be thru-bolted or per the manufacturer's listing requirements. All devices to conform to NFPA 80 and 101 requirements.

E. All exit devices to be of a heavy duty, chassis mounting design, with one piece removable covers, eliminating necessity of removing the entire device from the door for standard maintenance.

F. All trim to be thru-bolted to the lock stile case.

G. Exit devices shall be push pad devices finished to match that of the locksets. Push pad to be high impact resistant black lexan with a maximum 3 inch projection.

H. Rail assemblies of all exit devices to be of solid stainless steel, as required in the hardware schedule.

I. Removable Mullions to be heavy duty steel 12-L980@rated, and L980S@non-rated.

J. Exit devices shall comply with UBC Std-10-4 and CBC 1003.3.1.9.

2.07 CLOSERS

A. All closers to be the product of a single manufacturer for continuity of design and consideration of warranty.

B. Closers shall be Sargent 351 Series x P10/PH10/CPS/CPSH and as specified. Hold-open devices are not to be furnished at air-conditioned spaces.

C. Closers shall be heavy duty, surface mounted, and hydraulic type, with high strength cast case. Full rack and pinion constructed of heavy steel.

D. Size all closers in accordance with the Mfr's recommendations at the work site.

E. Closers to have adjustable spring power, which allows for closer sizing. Closers to have separate tamper resistant, non-critical regulating screw valves for closing speed, latching speed and backcheck control as standard features.

F. Closer arms to be forged steel, interchangeable with all closers specified on this project for simplification of future Owner maintenance considerations.

G. Supply appropriate arm assembly for each closer so that closer body and arm are mounted on non-public side of door opening and on the interior side of exterior openings, except where otherwise detailed.

H. All closers to be rectangular, full cover type of non-ferrous, non-corrosive material painted to match lockset finish.

I. Refer to 3.02.A.8 Installation for CBC opening force requirements.

2.08 PUSH PLATES, DOOR PULLS AND KICKPLATES

A. All push plates, door pulls, kickplates and other miscellaneous hardware as listed in hardware sets.

B. Supply 18 GA [.050] thick stainless steel, beveled 4 sides. Doors with louvers narrow bottom rails, kickplate height to be 1 inch less than the dimension shown from the door bottom to the bottom of the louver or glass.

1. Kickplates to be 10 inches high and Mop plates to be 6 inches high, both by 2 inches or 1 inch less than the door width as specified.

2. Armor plates, edge guards and protective hardware to be supplied in sizes as scheduled in the hardware sets.

2.09 DOOR STOPS

A. Door stops to be furnished for every door leaf. OH stops shall be furnished when a wall and/or floor stop is unacceptable. Exterior outswinging door floor stop shall be Trimco's 1209HA x 630. 1214CK at interior. Wall stops to be Trimco's 1270SV.

B. Install door stops in such a position that they permit maximum door swing, but do not present a hazard or obstruction. Floor stops must be installed within (4) four inches of the adjacent wall max, and within 4 inches from the strike edge of door.

C. Where overhead stops are specified, or otherwise required for proper door operation, they are to be heavy duty and of extruded brass or bronze with no plastic parts. No steel channels, arms, or brackets allowed.

2.10 AUTOMATIC FLUSH BOLTS, COORDINATORS AND SILENCERS

A. Furnish automatic flushbolts with dust proof strikes and coordinators as detailed and/or as required in the respective hardware sets. Finish to match adjacent hardware.

B. Silencers to be furnished as follows:
   1. Three [3] each at single doors and two [2] each at pairs of doors.

2.11 THRESHOLDS AND GASKETING

A. Supply materials and finishes as listed hardware sets. All thresholds must be in accordance with the requirements of the ADA and CBC 1133B.2.4.1.
   1. Furnish thresholds with machine screws and lead anchors. Furnish all necessary anchoring devices for gasket and seal.
   2. Thresholds may require modification based on final drawings and frame/floor details.
   3. All listed thresholds to be verified with final construction drawings/elevations, and as dictated by existing sill conditions.
   4. Contractor shall review the score and pour application with the Project Architect. Procedure will allow for the installation of Pemko's plate threshold system as detailed or required as determined by the Contractor's required door field survey, and final elevation drawings.
   5. Rated openings: omit threshold at 20 Minute rated openings, unless otherwise required per plans/elevations.

2.12 FINISH

A. Special care shall be taken to coordinate the finish of the various manufacturers to insure a uniform finish. This finish shall match the finish of the locksets.
   1. Plated hardware shall be BHMA626 [US26D] or as detailed in US32D.

B. Painted hardware items shall be lacquered to closely match plated hardware.

2.13 KEYING

A. Furnish locks and exit devices requiring (6) six pin cylinders which comply with performance requirements of ANSI A156.5.

B. Exit Devices, mortise locks and cylinders shall be supplied from the same manufacturer.

C. All cylinders and keys shall be stamped per district stamping requirements. Visual Key Control to consist of stamping cylinder plugs and all keys. Review w/district.

D. The contractor and hardware supplier shall be responsible with requesting permanent keying information from the owner. The owner will provide keying information to a Door Security Solutions Representative for coordination.

E. All locksets, exit devices and cylinders shall be furnished with existing Sargent restricted keyway [keyway to be identified by the District].
   1. All locksets, panic devices and cylinders shall be factory masterkeyed per District's direction. Furnish key quantities per 2.13.H.
   2. The Contractor shall be required to furnish temporary construction cylinders
      required to secure project doors during the construction period.
   3. All cylinders to be properly tagged to indicate intended locations.

F. Existing locksets, panic devices and cylinders:
   1. Where occurring, any existing lockset, panic and cylinders are to be replaced with new mortise, rim or cylindrical lock type cylinders as determined by Contractor's survey.
   2. Contractor will ensure that all replacement cylinders include the correct operating cam and/or tailpiece as determined by the Contractor's survey. Contractor will ensure that replacement cylinders are correctly installed into existing locking devices, and operate properly to the District's satisfaction.

G. Cylinders for non-Sargent locking components will be shipped loose to include: Marks, accordion, Adams-Rite, operable wall, rolling, sliding doors, and as listed and required in the work. Verify with respective manufacturer's required cylinder, and correct operating cam and/or tailpiece.
   1. Prior to Marks lockset installation, Contractor will be responsible for the attachment of Marks' 10L Tailpieces to Sargent's 13-3266 Cylinders, and the installation of the complete cylinder to Marks' locksets.
   2. Contractor shall add for labor to install permanent cylinders in locksets.

H. All Masterkeys shall be delivered to the District's designated representative via registered mail "Return Receipt Requested."

I. Supply keys in the following quantities:
   1. Two thousand (2000) six-pin factory original nickel silver key blanks in the designated keyway.
   2. Seventy (70) Master keys.
   3. Four (4) change keys per lockset, panic, and cylinder.
   4. Permanently inscribe each key with the Mfrs name and "Do Not Duplicate." Review stamping with District's Lockshop before entering factory P.O.

J. Furnish one (1) wall mounted steel key cabinet complete, similar to model AWS as manufactured by Telkee with a capacity of 125 percent of the number of locks required for project. Provide complete file and cross index file. All indexing and hanging of keys will be by the District.
   1. Review cabinet and type with District during keying conference.

K. Furnish two (2) complete pin kits [437C] x one thousand (1000) extra of each pin and driver size as required for the manufacturer's key system.

2.14 PROPRIETARY PRODUCTS

A. Refer to Para 1.02. Unless otherwise approved, furnish only the specified products.

PART 3: EXECUTION

3.01 INSPECTION

A. After installation has been completed, hardware supplier shall have a qualified Hardware Consultant [AHC] inspect project to determine the proper application of hardware according to the approved hardware and keying schedules.
   1. Check operation and adjustment of all hardware items.
   2. Recommended hardware adjustments shall be made by the Contractor/Installer.

3.02 INSTALLATION

A. Installation of finish hardware is specified under other sections. However, the following requirements apply to the work as follows:
   1. Hardware shall be installed by a qualified mechanic skilled in the application of institutional grade builder's hardware.
   2. Install all hardware in full compliance with manufacturer's instructions. When cutting and fitting is required to install hardware onto or into surfaces which are to be painted or finished, install each item completely and then remove during application. After completion, re-install each item.
   3. Care shall be exercised not to mar or damage adjacent work. Damaged work shall be repaired or replaced to the satisfaction of the Architect.
   4. Provide adequate backing in stud partitions for the attachment of all respective finish hardware.
   5. If door swing is changed from original drawings during construction, the contractor shall make necessary changes at no cost to the owner.

6. Latches and bolts shall be installed to automatically engage strikes, whether activated by closers or manual push. In no instance should unusual manual pressure be required to engage latch or bolt in strikes. Install locks with keyways in proper position, with levers, roses, and/or escutcheons firmly affixed. Adjust strikes after silencers and/or seal are in place.
7. Predrill pilot holes in wood for screws. Drill and tap for surface mounted hardware on metal. Set hinge leaf snug and flat in mortises, turn screws to flat seat [do not drive].
8. Closers are to have opening force adjusted to comply with current applicable accessibility requirements as follows: interior doors 5 pounds maximum pressure; exterior doors 5 pounds maximum pressure; fire doors 15 pounds maximum pressure, per CBC Section 1133B.2.5. Per CBC Section 1133B.2.5, the Authority having jurisdiction may increase the maximum effort to operate fire doors to achieve positive latching, but not to exceed 15 lbs. maximum.
9. Door closers when provided then the sweep period of the closer shall be adjusted to so that from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3" from the latch, measured to the landing side of the door. Refer to 1133B2.5.1.
10. Mount closers and overhead stops/holders in accordance with the manufacturer's template for the degree of swing indicated on the drawings [180 degree swing where conditions allow].
11. Floor stops must be installed within (4) four inches of the adjacent wall maximum, and within (4) inches from the strike edge of door Policy 99-08.
12. Wall stops to have wall surfaces prepared and reinforced. All hardware shall meet the requirements of CBC Sections 1133B.2.1, 1133B.2.5.1 and 1003.3.1.8.
13. Door Sweeps and Seals to be installed with attachment screws placed within a minimum of one [1] inch from the end of the seal and sweep.
14. Panic hardware shall comply with UBC standards 10-4 and shall be mounted 36" to 44" above the finish floor surface.
15. The unlatching force shall not exceed 15# applied in the direction of travel. Panic devices shall comply with CBC Section 1003.3.1.9.
16. All hardware shall meet the requirements of CBC Sections 1133B.2.1, 1133B2.5.1 and 1003.3.1.8.

B. HARDWARE LOCATIONS: Review and verify mounting locations with the Architect before issuing templates and door/hardware purchase orders. Mounting height of latching hardware shall be 36" to 44" FF per CBC Section 1133B.2.5.2. The following hardware locations shall be adhered to unless modified by the Architect. Minor adjustments are permitted to meet specific door mfr's standards.

1.	40 inches	Locksets, Panic Devices and Roller Latches-centerline of strike from bottom of frame.
2.	42 inches	Pull Plates-centerline of grip from bottom of frame.
3.	42 inches	Combination Push Bars-centerline from btm of frame.
4.	44 inches	Push Plates-centerline from bottom of frame.
5.	Hinges	Per manufacturer's standard.

C. THRESHOLD AND PERIMETER SEAL:
1. Cut and fit thresholds to profile of door frames, with mitered corners and hairline joints.
2. On exterior doors, set thresholds in a bed of sealant.
3. Before installation, carefully read manufacturer's instructions to assure tight and contiguous seal at the perimeter and corners of doors and frames.
4. Specified thresholds are subject to modification. Review final elevations.
5. Thresholds shall comply with CBC Section 1133B.2.4.1.

3.03 ADJUSTING AND CLEANING

A. At final completion, all hardware shall be left clean and free from disfigurement. Contractor shall make a final adjustment to all door closers and other items of hardware. Where hardware is found defective, repair or replace or otherwise correct as directed.
1. Following the activation of building heating and air conditioning system, the Contractor shall readjust all exterior and interior door closers.

B. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Adjust hardware so that moving parts operate freely, without bind, or excessive play. Hardware shall be free of paint, corrosion, or damage of any kind.

3.04 PROTECTION

A. The Contractor is responsible for the proper protection of all items of hardware until the owner accepts the project as complete.

3.05 OWNER'S STOCK

A. Refer to 1.06 for close-out requirements.

B. Contractor/Installer to carefully remove and protect replaced hardware, and deliver all replaced and new unused finish hardware to the District Lockshop.

3.06 MANUFACTURER'S ABBREVIATIONS OF LISTED HARDWARE

[MAR] MARKS
[MCK] MCKINNEY
[SGT] SARGENT
[TRM] TRIMCO

Items listed in the following Finish Hardware Schedule shall conform to the specification. The last column in the hardware schedule refers to the manufacturer's abbreviation listed above.

3.07 HARDWARE SETS

BUILDING M – DOORS M1118, M119, M120, M121, M122, M123

HW16A **[INTERIOR/CLASSRM/CLOSER]**

EACH SGL TO HAVE:

			FIN	MFR
3 EA.	HINGE	T4A3786 4.5x4.5	652	MCK
1 EA.	LOCKSET	195Sx10Lx4-7/8 STK	626	MAR
1 EA.	CYLINDER	13-3266	619	SGT
1 EA.	CLOSER	351DA-HxTB [180-DEGREE SWING]	689	SGT
1 EA.	KICKPLATE	K0050 10x2 LDW	630	TRM
1 EA.	STOP	1214CK	626	TRM
3 EA.	SILENCER	1229A	GR	TRM

END OF SECTION

SECTION 09 06 00

SCHEDULE FOR FINISHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior and Exterior Finish Schedule.

B. Related Sections as scheduled.

C. General Contractor to refer to Division 1, Product Requirements Section 01600 for conditions and requirements for product substitutions.

D. Contractor to provide order schedule of specified products.

1.02 PRODUCT OPTIONS

A. Products Specified by Naming One or More Manufacturers: Products of manufacturers named and meeting or exceeding Specifications. Substitutions permitted only under provisions of Division 1, Product Requirements Section 01 60 00.

B. When the words "or equal" are used, it shall mean "or equal as approved by the Architect in accordance with Division 1, Product Requirements Section 01600.

C. "Or equal" products shall conform to requirements listed in this Section and following criteria:
   1. 10 successful installations, have been in operations and maintenance-free for 5 years as minimum.

D. Samples are required for all items and the Architect will be the sole judge in determining the degree of acceptable difference from the listed color and/or finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. As scheduled herein and specified in individual sections.

PART 3 EXECUTION

3.01 SCHEDULES

A. DIVISION 09 – FINISHES

1. 09511 – Acoustic Ceiling – Lay-In
AC1:
Mfg.: Armstrong
Style: 1714 Fine Fissured
Color: Factory Finish White
Size: 2'x4'

2. 09653 – Top Set Base
B1:
Mfg.: Burke Mercer
Style: Rubber Top Set Base
Color: 701 Black
Size: 4"

3. 09680 – Sheet Carpeting
C1:
Mfg.: Bigelow Commercial
Style: Fairfield II
Color: BC 104/3573 Ember Dusk
Backing:
Size: 12' broad loom

4. 09900 – Painting and Coating
P1: Interior Field Paint
Mfg.: ICI
Color: Designer Grey 50YY 63/041

D. DIVISION 10 – SPECIALTIES

1. 10121 – Tackable Wall Panel (Full ht. Tack wall)
WC2:
Mfg.: Koroseal
Style: Ceres
Color: B321-91 Fog

END OF SECTION

SECTION 09 29 00

GYPSUM BOARD

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Gypsum Board Panels.

B. Vertical wall gypsum board application.

C. Taped and sanded joint treatment.

D. Related Sections
   1. Section 06 10 00 - Rough Carpentry.
   2. Section 09 90 00 - Painting

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)
   1. ASTM C475 - Joint Compound and Joint Tape for Finishing Gypsum Board.
   2. ASTM C840 - Application and Finishing of Gypsum Board.
   3. ASTM C954 – Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. to 0.112 in. in thickness.
   4. ASTM C1002 - Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases.
   5. ASTM C1396 - Specification for Gypsum Board.

B. Gypsum Association (GA)
   1. GA-201 - Gypsum Board for Walls and Ceilings
   2. GA-214 - Levels of Gypsum Board Finish
   3. GA-216 - Application and Finishing of Gypsum Board

C. 2007 California Building Code (CBC)
   1. CBC-7 - Chapter 7, Fire Resistant Materials and Construction
   2. CBC-19A - Chapter 19A, Concrete (for DSA)
   3. CBC-25 - Chapter 25, Gypsum Board and Plaster

1.03 SUBMITTALS

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

B. Shop Drawings: Show locations, fabrication, and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other units of Work.

C. Samples: For following products:
   1. Trim Accessories: Full-size sample in 12-inch- long length for each trim accessory indicated.

1.04 QUALITY ASSURANCE

A. Applicator: Company specializing in gypsum board systems work with three years experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Stack gypsum panels flat to prevent sagging.

C. Steel Framing and related accessories shall be stored and handled in accordance with AISI Code of Standard Practice.

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products of following manufacturers form basis for design and quality intended.
   1. United States Gypsum Corporation (USG), Chicago, IL. Products shall contain no VOCs.
   2. Georgia-Pacific, Atlanta, GA. Products shall contain no VOCs.
   3. National Gypsum Co./Gold Bond Building Products, Charlotte, NC. Products shall contain no VOCs.

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

2.02 BOARD MATERIALS

A. Regular Gypsum Board: ASTM C1396; 5/8 inch thick, maximum permissible length; ends square cut, tapered round edges, USG SHEETROCK BRAND TAPERED GYPSUM PANELS.

B. Fire-rated Gypsum Board: ASTM C1396; Type X, fire resistive type, UL Listed; 5/8 inch thick, maximum permissible length; ends square cut, tapered round edges, USG SHEETROCK BRAND, FIRECODE "C" Core, or equal.

2.03 MATERIALS

A. Furring Channels: 25 gauge galvanized steel, 7/8 inch deep by 2-9/16 inch wide hat channels, 275 pounds per 1,000 feet weight, FHC-25 and CEMCO METAL FURRING CHANNEL CLIPS. Z Type, where required: CEMCO Z-FURRING CHANNEL, 1", 1-1/2", 2" and 3" depths.
   1. Dietrich UltraSteel Framing, 25 gauge or equal.

B. Angles: 1-3/8 inch by 7/8 inch, 24 gauge, Dietrich Metal Framing, CEMCO GALVANIZED METAL ANGLES or equal.

C. Runner Channels: Minimum weights, sizes and maximum spans conform to reference standard listed in Table 2506.2 California Building Code, 1-1/2", 1.12 lbs/foot, hot-rolled channels as defined therein.

D. Hanger Wire: 8 gauge for 16 square feet maximum, galvanized annealed, size of wire in accordance with reference standard listed Table 2506.2, California Building Code.

E. Tie Wire: 18 gauge galvanized annealed.

F. Taping, Bedding and Finishing Compound: ASTM C475; compatible with tape and substrate.
   1. USG SHEETROCK Brand Taping Joint Compound Ready-Mixed, drying-type, non-asbestos, vinyl base.
   2. USG SHEETROCK Brand Topping Joint Compound Ready-Mixed, drying-type non-asbestos, vinyl base.
   3. USG SHEETROCK Powder Joint Compound, drying-type, non-asbestos vinyl base, conventionally drying. For Taping and Topping.
   4. USG SHEETROCK Powder Setting-type Joint Compound, chemical hardening.
   5. Contractor's Option: USG SHEETROCK Lightweight All Purpose Joint Compound (Plus 3) with Dust Control.
   6. USG SHEETROCK Brand All Purpose Joint Compound Ready-Mixed for laminating gypsum panels in multilayer partitions.
   7. USG SHEETROCK Brand Joint Tape, ASTM C475, high strength cross-fibered paper tape.
   8. Drywall Primers: USG First Coat.
   9. Or equal as approved in accordance with Division 01, General Requirements for substitutions.

G. Accessories: Corrosive Protective-Coated steel.
   1. U-Trims: USG, Dietrich No. 200-A for joint compound or equal.
   2. J-Trim Casings, reveal type: USG, Dietrich No. 401 for 1/2" panels, 402 for 5/8" panels, no finishing compound.
   3. Control Joint: Dietrich 093, USG Control Joint No. 093.
   4. Corner Bead: USG, Dietrich No. 103 for joint compounds or equal.

H. Fasteners: Self-drilling tapping screws shall comply ASTM C 954; Self piercing screws shall comply ASTM C 1002;
   1. ASTM C1002, No. 2 Phillips recessed, bugle head, power-driven. Nails not permitted.

2. Type S-12, ASTM C954, 16 gage steel studs, minimum penetration 3/8 inch.
3. Type S, ASTM C 1002, 20 gage steel studs, minimum penetration 3/8 inch.
4. Type G, gypsum board to gypsum board, minimum penetration 1/2 inch.
5. Type W, wood construction, minimum penetration 5/8 inch.

I. Reveal Moldings: Extruded aluminum moldings as detailed and as manufactured by Fry Reglet Co., Alhambra, CA, or equal as approved in accordance with Division 01, General Requirements for substitutions. All intersections shall be factory fabricated with joints heliarc welded and backs sealed with permanent waterproof tape. Furnish with 6 inch legs to join with straight sections. Provide connector clips at butt joints of straight sections and end caps at terminations. Color as selected by Architect.

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify that site conditions are ready to receive Work.

B. Beginning installation means acceptance of substrate.

3.02 PREPARATION

A. Delivery and Storage: Arrange for an adequate supply of materials on the jobsite so that progress of Work will be uninterrupted. Materials and accessories shall be delivered in original containers and bundles, and identified with the manufacturer's name and brand. Store gypsum board on flat, solid supports in dry areas, well protected from the elements.

B. Provide fixtures, anchors, sleeves, inserts and miscellaneous items, and provide openings and chases as necessary. Prior to closing in and finishing of dry wall Work, ascertain that piping, conduit, ductwork and fixtures which are to be concealed and which penetrate gypsum boards are in place, tested and approved.

C. Scaffolding: Construct, erect and maintain in conformance with applicable laws and ordinances.

D. Protection, Patching and Cleaning: Adjacent surfaces of other materials shall be protected from damage. Dry wall surfaces that have been cut out shall be neatly patched. Damaged or defective gypsum board finish shall be replaced. During progress of Work, rubbish droppings and water materials shall be removed.

E. Fire Protection: Where required, the Work shall comply with the requirements for the protection rating indicated in the governing building code.

F. Fire Sprinkler System: In areas where sprinkler heads occur, exercise care when installing drywall work. Do not damage or obstruct the heads in any way.

3.03 GYPSUM BOARD INSTALLATION

A. Install gypsum board in accordance with ASTM C840, GA 201, GA 216 and Section 2508 California Building Code. Use board types as indicated; if not indicated use board types as follows.
   1. Use Type X (fire-rated core) drywall unless indicated otherwise.

B. Erect single layer gypsum board parallel or perpendicular on vertical framing, attached to studs and framing members with the specified fasteners spaced at 12 inches on centers at top and bottom and 12 inches on centers in the field. Solid backing not required at joints running perpendicular to studs and framing members.
   1. In wood framing construction erect gypsum board panels perpendicular only.
   2. For walls requiring STC 50 or higher, install extra layer of 1/2" gypsum board on one side, unless noted otherwise on wall schedule.

C. Place control joints consistent with lines of building spaces as indicated or at maximum of 30 ft on centers.

D. Place corner beads at external corners. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials.

E. Seal all cutout and penetrations: For electrical, mechanical, plumbing and structural framing cutouts and penetration at interior surfaces. Per Section 07 92 00 for non-rated wall, and fire-rated sealant for rated walls per section 07 84 00.

F. Install reveal moldings according to manufacturer's recommendations.

3.04 JOINT TREATMENT

A. Exposed gypsum board in wall areas and ceiling areas shall have joint compound and be taped and sanded per requirements of GA-114 for levels specified and ready for paint.

B. On installations where two layers of gypsum board are required, only the face layer will require finishing of joints and screwheads.

C. Gypsum wallboard joints in walls may either be exposed or covered with joint tape and joint compound for the portion of the wall above a suspended ceiling, which is part of a fire resistive floor-ceiling or roof-ceiling assembly, as listed in U.L. Fire Resistive Ratings (BXUV), when the following conditions are met:
   1. Vertical joints occur over framing members.
   2. Horizontal joints are staggered 24 inches on opposite sides or covered with 6 inch wide strips of gypsum board attached with 1-1/2 inch laminating screws at 8 inches on centers.
   3. Partition is two-ply system with joints staggered 16 inches or 24 inches.
   4. Partition is not part of a smoke or sound control system.

D. Sound-Rated Partitions: Perimeters and penetrations of sound-rated partitions shall be caulked with acoustical sealant as specified in Section 07 92 00, both sides of partition.

E. Joints, except where excluded above including internal corners, shall be filled and taped. Thin uniform layer of joint compound, approximately 3 inches wide, shall be applied over joint. Tape shall be set in joint compound and finish levels required below. Internal angles, both horizontal and vertical, shall be reinforced and with tape folded to form straight and true angle. Metal external corners shall be set in place. Joints shall be allowed to dry at least 24 hours between each application of cement.

F. Gypsum board finish shall be to the following levels as defined by GA-214:
   1. Plenum areas above ceilings - Level 1.
   2. Substrate for tile, tackable wall panels, tackboards and markerboards - Level 2.
   3. Areas receiving heavy textured paint - Level 3.
   4. Areas receiving vinyl wall covering, texture finish or light textured flat paint - Level 4.
   5. All Areas receiving non-textured, flat, egg-shell, gloss or semi-gloss paint - Level 5. Backroll application of sealer. Level 5 requires one of the following.
      a. Skim coat: A thin skim coat of joint compound, or a material manufactured especially for this purpose, shall be applied to entire surfaces. Surfaces shall be smooth and free of tool marks and ridges.
      b. Acrylic latex-based coating, spray apply: USG SHEETROCK Brand Primer-Surfacer Tuf-Hide or ProForm Surfacer/Primer by National Gypsum or equal. Apply to 15-20 mils wet film thickness to entire surface.
      c. Prep Coat Plus by Hamilton Materials Inc, Orange, CA. [Smooth Coat 5 by Westpac Materials.]
      d. Additionally apply primer coat per Section 09 90 00 Painting.

3.05 TOLERANCES

A. Maximum Variation from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION

SECTION 09 51 00

ACOUSTICAL CEILINGS - LAY-IN

PART 1 - GENERAL

1.01 WORK INCLUDES

A. Acoustical panels, lay-in.

B. Related Sections:
   1. Section 09 53 23, Acoustical Suspension Systems.

1.02 REFERENCES

A. CBC - California Building Code, 2007.

B. ASTM E84 - Surface Burning Characteristics of Building Materials.

C. ASTM E1264 - Acoustic Ceiling Products.

1.03 SUBMITTALS

A. Product data for acoustical panels.

B. Three samples illustrating material and finish of acoustic units.

C. Manufacturer's installation instructions.

1.04 QUALITY ASSURANCE

A. Qualifications
   1. Manufacturer: Company specializing in manufacture of ceiling panels with five years minimum experience.
   2. Installer: Company with three years minimum experience.

B. Fire Classification Requirements: ASTM E84, flame spread of less than 25 and smoke density rating of less than 450, Class I, California Building Code Table 803.5.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Interior wet work shall be completed prior to installation of panels. Windows and doors shall be in place. HVAC systems shall be installed and operable where necessary to maintain a temperature range of 60 to 85 degrees F and maximum 70 percent relative humidity.

1.06 EXTRA STOCK

A. Provide extra quantity of acoustic units in the amount of one box of each type specified.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products of the following manufacturers form the basis for design and quality intended.
   1. Armstrong World Industries, Fullerton, CA.
   2. USG Corporation, Chicago, IL.
   3. Certainteed Celotex, Tampa, Fl.

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

2.02 MATERIALS

A. Acoustical Panels: Armstrong Fine Fissured 1714, ASTM E1264.
   1. Size: 12 x 12 inches
   2. Thickness: 3/4 inches
   3. Light Reflectance: 0.85.
   4. NRC: 0.70.
   5. CAC: Minimum 35.
   6. Edge: Square edge.
   7. Surface Color: Factory White.

B. Retention Clips: Armstrong #414 Retention Clip or equal. Refer to INSTALLATION Part 3 for conditions requiring clips.

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify that existing conditions are ready to receive work.

B. Verify that layout of hangers will not interfere with installation of acoustic units.

C. Beginning of installation means acceptance of existing conditions.

3.02 INSTALLATION

A. Fit acoustic units in place, free from damaged edges or other defects detrimental to appearance and function.

B. Where square units are indicated, lay directional patterned units in basket weave pattern. Fit border neatly against abutting surfaces.

C. Install acoustic units level, in uniform plane, and free from twist, warp and dents. Replace damaged or soiled units.

D. Provide for complete accessibility for all units.

E. Install Retention Clips at non-rated gym-corridor ceilings or multipurpose corridor ceilings], and panels weighing more than 1/2 psf other than acoustical panels.

END OF SECTION

SECTION 09 65 13

RESILIENT BASE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Resilient base, rubber.

B. Accessories.

1.02 REFERENCES

A. ASTM E648 and NFPA 253 - Critical Radiant Flux of Floor Covering Systems.

B. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials

C. ASTM F1861 - Resilient Wall Base.

D. SCAQMD – South Coast Air Quality Management District Regulations Rule 1168 Adhesive and Sealant Applications.

1.03 FIRE CLASSIFICATION REQUIREMENTS

A. ASTM E648, NFPA 253: Class 1, Critical Radiant Flux Flame Spread Value: minimum 0.45 watts per sq cm.

B. ASTM E84, smoke density less than 450.

1.04 SUBMITTALS

A. Product data on specified products and colors available.

B. Three 6 inch long samples of base material for each color selected.

C. Manufacturer's installation instructions.

D. Maintenance procedures and recommended maintenance materials.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Store materials for three days prior to installation in area of installation to achieve temperature stability.

B. Maintain minimum 70 degrees F temperature three days prior to, during and 24 hours after installation of materials.

C. Provide adequate ventilation to carry off volatile fumes.

1.06 WARRANTY

A. Submit under provisions of Division 01, General Requirements.

B. Provide manufacturer's 1 year warranty against defects and wear-through.

1.07 REPLACEMENT MATERIALS

A. Provide minimum three percent of all materials furnished for each color and size of materials installed.

PART 2 - PRODUCTS

2.01 MANUFACTURERS, RUBBER

A. Burke Mercer Flooring Products, San Jose, CA.

B. Johnsonite, Chagrin Falls, OH.

C. Nora Flooring Systems, Lawrence, MA.

D. Endura Co., Waltham, MA..

E. Roppe Corp., Fostoria, OH.

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

2.02 BASE MATERIALS

A. Base: Rubber, 1/8 inch gauge, standard toe, 4 inches.

B. Base material shall meet ASTM F1861 Type TS for rubber, Group I or II, Style A Straight (toeless) profile for carpet and Style B Coved profile for hard surface floors [and Style C "Butt-to" meet flooring thickness.]

C. Base Accessories: Premolded end stops, internal and external corners of same material, size and color as base.

D. Adhesive: As recommended by the manufacturer and if full compliance with the California VOC regulations.

E. Colors: 701 Black, 502 Brown by Burke.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are smooth and flat with maximum variation of 1/8 inch in 10 ft and are ready to receive Work.

B. Verify that surfaces are finished, ready to receive base installation.

C. Beginning of installation means acceptance of existing substrate and site conditions.

3.02 INSTALLATION - BASE MATERIAL

A. Fit joints tight and vertical. Maintain minimum measurement of 18 inches between joints.

B. At 90 degree external corners use premolded units only. At corners more or less than 90 degrees, shave a vertical strip down the back side of the material, 1/4 inch wide and not more than 1/2 the thickness at the point of bend. Bend coved toe to required angle. Bond material firmly to wall on both sides of joint to ensure a tight fit with no open void at top.

C. At 90 degree internal corners use premolded units only.

D. Install base on solid backing. Bond tight to wall and floor surfaces.

E. Scribe and fit to door frames and other interruptions.

3.03 CLEANING

A. Remove excess adhesive from floor, base and wall surfaces without damage.

B. Protection: Protect work until completion. Repair or make good any damage to this work and other materials damaged during installation of base material.

3.04 SCHEDULE

A. Install at all walls not specified to receive integral base and as scheduled in the finish schedule.

END OF SECTION

SECTION 09 72 19

FABRIC COVERED TACK SURFACE

PART 1 GENERAL

1.01 WORK INCLUDED

A. Fabric covered tack surface.

1.02 REFERENCES

A. ASTM C208 - Insulating Board (Cellulosic Fiber), Structural and Decorative.

B. ASTM E84 - Surface Burning Characteristics of Building Materials.

C. Chapter 8, California Building Code, Interior Wall and Ceiling Finish.

1.03 FIRE CLASSIFICATION REQUIREMENTS

A. Fabric: ASTM E84; flame spread less than 25, smoke density less than 450 in accordance with Table 8A California Building Code.

B. Core: ASTM E84; flame spread less than 75, smoke density less than 450.

1.04 SUBMITTALS

A. Submit product data.

B. Submit three samples of core material and fabric.

1.05 QUALIFICATIONS

A. Fabricator/Installer: Company specializing in applying the work of this section with minimum three (3) years experience.

1.06 DELIVERY, STORAGE AND HANDLING

A. Package tack surface panels face-to-face and back-to-back to protect fabric face during shipment.

B. Provide wrapping of bundles.

C. Store bundles to prevent warping and damage from moisture or impact.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Products of the following manufacturers form the basis for design and quality intended.
   1. RJF International Corporation, Fairlawn, OH.
   2. MDC Wallcoverings, Elk Grove, Illinois.

B. Or equal as approved in accordance with Division 1, General Requirements for substitutions.

2.02 MATERIALS

A. Vinyl Coated Fabric: Koroseal, "Ceres" or "Desert Sand" as selected by Architect from manufacturer's full color range, complying with Federal Specification CCC-W-408 A, Type II, flame spread less than 15, smoke density less than 20, ASTM E84, NFPA 225.

B. Fiberboard Core System One Of The Following:
   1. Core: 1/2 inch thick, fiberboard complying with ASTM C208, medium density cellulose fiber insulating board.
      a. Primer: Alkyd type, No. 88-1, by Dunn Edward Corp., Los Angeles, CA., or No. 3210 PRIMER undercoater, by ICI Paints Commerce, CA, or equal as approved by adhesive manufacturer.
      b. Adhesive: As recommended by manufacturer for application of fabric to core material and for application of assembled panel to gypsum board substrate.
   2. Core: 1/2 inch thick lightweight wood fiber panel as manufactured by Wood Fiber Industries, a division of Masonite Corp., Chicago, IL., or equal. Density ironed 18 lbs per cubic foot, Class C complying with ASTM C208, flame spread 45 or less, smoke density 45.
      a. Adhesive: Special formulation for machine lamination of fabric to ironed core, eliminating need for primer. As recommended by manufacturer for application of assembled panel to gypsum board substrate.

2.03 FABRICATION

A. Apply specified primer where required to fiberboard core.

B. Fabric shall be bonded to the fiberboard core on exposed face and wrapped around vertical, or long edges overlapping back approximately 1-1/2 inches. Wrap all edges and joints where visible.

PART 3 EXECUTION

3.01 INSTALLATION

A. Uniformly spread adhesive on substrate and install panels in one piece beginning at center point of wall and working to room corners. Panels shall be plumb and level and fit snugly at joints and to the substrate.

B. Provide square edges where indicated.

C. Unless indicated otherwise, all edges shall be trimmed, mitered at corners.

3.02 CLEANING

A. Remove all adhesive and soil marks from exposed surfaces.

END OF SECTION

SECTION 09 90 00

PAINTING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes providing fluid applied paints and coatings. Upon completion of Work, all visible interior and exterior surfaces, within the Contract limits including factory primed or factory finished roof mounted mechanical and electrical equipment, shall have a painter's finish unless scheduled "Not To Be Painted" in this Section.

1. Each paint system includes:
   a. Surface preparation, including touch-up of shop applied primers, if needed.
   b. Prime coat application, where scheduled as part of finish system.
   c. Finish coat application, where scheduled apply two or more finish coats.
2. Paint semi-concealed areas (e.g. inside of light troughs and valances, behind grilles, and projecting edges above and below sight lines, behind wall-mounted items).

B. Surfaces Not To Be Painted:

1. Prefinished wall, ceiling, and floor coverings.
2. Items with factory-applied final finish except roof-mounted equipment as defined above.
3. Concealed ducts, pipes, and conduit.
4. Glass, plastic laminate, ceramic tile, anodized aluminum.
5. Surfaces of steel items that will be embedded in concrete.
6. Surfaces specifically scheduled or noted on the Drawings not to be painted.
7. Fire-Rating labels on doors and frames.
8. Performance Rating labels on equipment.

1.02 REFERENCES

A. ASTM – American Society for Testing and Materials

1. ASTM D4442 - Direct Moisture Content Measurement of Wood and Wood-Base Materials.
2. ASTM D4444 - Use and Calibration of Hand-Held Moisture Meters

B. SSPC - Steel Structures Painting Council.

C. SCAQMD – South Coast Air Quality Management District

1. SCAQMD-1113 - Rule 1113, Architectural Coatings

1.03 SUBMITTALS

A. Product Data for each paint system product and accessory item.

B. Chip deck of manufacturer's available colors.

C. Three Samples of each specified finish system color, texture, and sheen; samples shall be minimum 8-1/2 by 11 inches in size.
   1. Prepare transparent wood finish samples on type and quality of wood specified.

D. Manufacturer's application instructions.

E. Certified Copies of moisture test results.

1.04 QUALITY ASSURANCE

A. Manufacturers: Company with minimum 10-years experience manufacturing quality paint and finish products for commercial projects similar in scale and complexity to those required for this Project.

B. Applicator: Company with minimum 5-years experience painting and finishing commercial projects similar in scale and complexity to those required for this Project.

C. Materials, for each paint system, shall be by, or as recommended by, a single coating manufacturer for use together in commercial quality paint / coating system for the substrate and exposure conditions indicated.

D. Regulatory Requirements
   1. Conform to SCAQMD-1113 for maximum VOC limits, copies of Rule 1113 are available at Architect's office.
   2. Comply with applicable codes and regulations of authorities having jurisdiction including those with jurisdiction over airborne emissions and industrial waste disposal. Where those requirements conflict with this Specification, comply with the more stringent provisions.

E. Field Samples. Provide Field Sample of each finish system color, texture, and sheen scheduled. Do not proceed with coating application until sample panel has been approved.
   1. Field Sample shall be minimum 100 sq.ft, with least dimension of 10 ft.
   2. Locate as approved by Architect.
   3. Adjust materials and methods of installation as required to obtain Architect's approval.
   4. Document materials and methods used to obtain Architect's approval and maintain at least one copy of this documentation on site while related work is in progress.
   5. Maintain access to and protect Field Sample from damage while related work is in progress.
   6. Upon acceptance of related work, approved sample may remain as part of Work.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver products to site in their original, sealed, undamaged containers with labels intact and legible.
   1. Labels shall include manufacturer's name, type of paint, brand name, brand code, color designation, recommended surface preparation, typical coverage, drying times, cleanup procedures, and instructions for mixing and reducing, if permitted.

B. Store paint materials ambient temperatures between 45- and 90-degrees F, in well ventilated area unless permitted otherwise by manufacturer's instructions.

C. Take precautionary measures to prevent fire hazards and spontaneous combustion.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Provide continuous ventilation and heating facilities to maintain surface and ambient temperatures above 45 degrees F for 24 hours before, during and 48 hours after application of finishes, unless permitted otherwise by manufacturer's instructions.

B. Do not apply exterior coatings during rain, or when relative humidity is above 50 percent, unless permitted otherwise by manufacturer's instructions.

C. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

D. Minimum Application Temperature for Varnish and transparent Finishes: 65 degrees F for interior or exterior, unless permitted otherwise by manufacturer's instructions.

E. Provide lighting level sufficient to conduct painting operations.

1.07 MAINTENANCE

A. For each color, type, and gloss of paint used in the work provide, as Extra Materials, a quantity equal to approximately 10 percent of the quantity required for its installation rounded to the nearest gallon, or five gallons, whichever is less.

1. Extra Materials shall be from same production run as installed materials.
2. Label each container with locations and dates of related installations; do not obscure manufacturer's label.
3. Deliver Extra Materials to Site as directed by Owner.

1.08 GUARANTEE

A. Guarantee the painting Work against peeling, fading, cracking, blistering or crazing for a period of two years from the Date of Certified Completion for painting of new surfaces and existing surfaces.

PART 2 - PRODUCTS

2.01 PAINTS AND COATINGS

A. Acceptable Manufacturers. Products of following manufacturers form basis for design and quality intended.

1. Vista Paint, Fullerton, CA
2. ICI Paints
3. Dunn-Edwards Corporation, Los Angeles, CA
4. PPG Industries/Spectra-Tone Paint Corp.
5. Kelly-Moore Paints, San Carlos, CA
6. Or equal, approved in accordance with Division 01, General Requirements, for substitutions.

2.02 MATERIALS

A. Coatings: Ready mixed, except field-catalyzed coatings. Process pigments to soft paste consistency, capable of being readily and uniformly dispersed to homogeneous coating.

B. Colors and Glosses: As selected by Architect from manufacturer's full range of available colors. Architect will select color and hue to be used in various types of paint specified and will be sole judge of acceptability of various glosses obtained from materials proposed to be used in Work. During actual painting, Architect may make minor modifications in tone and shade to adjust for actual surface and lighting conditions encountered.

C. Undercoats and Thinners. Provide undercoat paint produced by same manufacturer as finish coat. Use only thinners recommended by paint manufacturer and use only to recommended limits. Use undercoat, finish coat and thinner material as parts of a unified system of paint finish.

D. Coatings: Good flow and brushing properties; capable of drying or curing free of streaks or sags.

E. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified of commercial quality.

2.03 APPLICATION EQUIPMENT

A. For application of the approved paint, use only such equipment as is recommended by the manufacturer.

B. Compatibility: Prior to actual use of application equipment, use all means necessary to verify that the proposed equipment is actually compatible with the material to be applied and that the integrity of the finish will not be jeopardized by use of the proposed application equipment.

2.04 FINISHES

A. Refer to schedule at end of Section for surface finish. Notwithstanding product numbers listed in schedule, Contractor shall conform to most recent product numbers as published by the manufacturer.

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify that surfaces are ready to receive Work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of Work. Report any condition that may potentially affect proper application.

C. Measure moisture content of new surfaces using an electronic moisture meter. Apply finishes only when moisture content of surfaces are below the following maximums. Conduct moisture measurements in presence of the project inspector, document readings and submit to Architect under Part 1.

1. Plaster and Gypsum Wallboard: 12 percent.
2. Interior Located Wood: 15 percent, measured in accordance with ASTM D4442 and ASTM D4444.
3. Exterior Located Wood: 19 percent, measured in accordance with ASTM D4442 and ASTM D4444.

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

3.02 MATERIALS PREPARATION

A. Mix and prepare painting material in accordance with manufacturer's recommendations.

B. Store materials not in actual use in tightly covered containers.

C. Maintain containers used in storage, mixing and application of paint in a clean condition, free from foreign materials and residue.

D. Stir all materials before application to produce a mixture of uniform density and as required during the application of materials. Do not stir into the material any film that may form on the surface. Remove the film and strain the material before using.

3.03 SURFACE PREPARATION

A. Remove electrical plates, hardware, light fixture trim and fittings prior to preparing surfaces for finishing.

B. Correct minor defects and clean surfaces which surfaces which affect Work of this section.

C. Shellac and seal marks that may bleed through surface finishes.

D. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

E. Insulated Coverings: Remove dirt, grease and oil from canvas and cotton.

F. Gypsum Board Surfaces: Fill minor defects, joints and nail head depressions with spackling compounds. Prime in accordance with primer manufacturer's recommendations. Apply primer over skim coat for Level 5 finish.

G. Plaster Surfaces: Fill hairline cracks, small holes and imperfections with patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

H. Surface Preparation for All Exterior Metal: Preparation in accordance with SSPC-6 Commercial Blast Cleaning.

I. Galvanized Surfaces:

1. Prepare galvanized steel and nonferrous metal surfaces in accordance with ASTM D 6386-Surface Preparation of Galvanized Surfaces and manufacturer's instructions.
2. Ensure surfaces are dry.
3. Interior Exposure (Dry/Benign): Remove visible oil, grease, dirt, dust, protective mill coatings, and other soluble contaminants in accordance with SSPC-SP 1 or manufacturer's instructions as specified for coating system. Hand or Power tool clean to remove all insoluble contaminants
4. Interior and exterior Exposure (moderate to severe): Remove visible oil, grease, dirt, dust, protective mill coatings, and other soluble contaminants in accordance with SSPC-SP 1 or manufacturer's instructions as specified for coating system. Follow initial cleaning with one of the following Methods:
   a. SURFACE PREPARATION METHOD A (Preferred): Thoroughly roughen the entire surface to be coated using compressed air brush off blast cleaning with a fine abrasive to achieve a uniform anchor profile of 1-2 mils. Reference ASTM D 6386-99 (2005) Section 5.4.1.
   b. SURFACE PREPARATION METHOD B (Alternate method when Method A is not feasible): Chemically Treat with one of the following products to etch the galvanized surface to be coated: Henkel Galvaprep 5 or Clean & Etch by Great Lakes Laboratory. Reference ASTM D 6386-99 (2005) Section 5.4.2.

J. Uncoated Steel and Iron Surfaces: Remove grease, scale, dirt and rust. Where heavy coatings of scale are evident, remove by wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts and nuts are similarly cleaned. Prime paint after repairs with Tnemec Series L69 Hi Build Epoxoline II or Carboline 890 VOC or approved in accordance with Division 01, General Requirements for Substitutions.

K. Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Spot prime bare steel surfaces to match existing primer.

L. Exterior Wood-Clear coats: apply exterior grade varnish.

M. Door and Window Frames, Side Lites, jambs and headers: clean and light sand smooth.

3.04 PROTECTION

A. Protect elements surrounding the Work of this Section from damage or disfiguration.

B. Repair damage to other surfaces caused by Work of this Section.

C. Furnish drop cloths, shields and protective methods to prevent spray or droppings from disfiguring other surfaces.

D. Remove empty paint containers from site.

3.05 APPLICATION

A. Apply products in accordance with manufacturer's instructions.

B. Do not apply finishes to surfaces that are not dry.

C. Apply each coat to uniform finish. Number of coats specified is a minimum. Additional coats shall be applied at no extra cost, if coatings show evidence of uneven application, uneven pigmentation, brush strokes or otherwise unsatisfactory distribution of material.

D. Under coats shall be lighter and brighter in tint than finish coat.

E. Sand lightly between coats to achieve required finish.

F. Allow applied coat to dry before next coat is applied.

G. Where clear finishes are required, tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

H. Paint Frames: Split paint door frames to match color of walls on each side of opening unless directed otherwise by Architect.

I. Exterior and interior walls shall receive 10% accent paint colors.

J. Paint finish shall continue through behind all wall-mounted items (e.g. markerboards, chalk and tack boards).

3.06 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

A. Refer to Section Divisions 22, 23 and 26 for color coding and identification banding requirements of equipment, ductwork, piping and conduit.

B. Paint shop primed equipment.

C. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

D. Prime and paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, metal louvers, brackets, collars and supports, except where items are pre-finished.

E. Replace identification markings on mechanical or electrical equipment when painted accidentally.

F. Paint interior surfaces of air ducts that are visible through grilles and louvers with one coat of flat black paint, to limit of sight line. Paint dampers exposed behind louvers and grilles to match face panels.

G. Paint exposed conduit and electrical equipment occurring in finished areas.

H. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.

I. Color code equipment, piping, conduit and exposed ductwork in accordance with requirements indicated. Color band and identify with flow arrows names and numbering, using stencils or other approved systems.

J. Replace electrical plates, hardware, light fixture trim and fittings removed prior to finishing.

3.07 CLEANING

A. As Work proceeds, promptly remove paint where spilled, splashed, or spattered.

B. During progress of Work maintain premises free of unnecessary accumulation of tools, equipment, surplus materials and debris.

C. Collect cotton waste, cloths, and material that may constitute a fire hazard, place in closed metal containers and remove daily from site.

3.08 FINISH SYSTEM SCHEDULE - EXTERIOR EXPOSURE

	Vista	Dunn Edwards
A. Wood - Flat - Acrylic		
1. Primer, 1 Coat	4200	W708
Finish, 2 Coats	2000	W704V
B. Wood - Semi-Gloss – Acrylic		
1. Primer, 1 Coat	4200	W708
2. Finish, 2 Coats	8400	W7500

C. Wood Clear Sealer – penetrating oil, ultraviolet ray protection
1. Primer "New Wood Defender" (The Flood Company)
2. Sealer 2 coats -CWF-UV

D. Wood - Preservative - Clear finish under paint system scheduled [natural gray finish].
1. Sealer, 2 Coats Monochem Aquaseal II for Wood Cuprinol Clear Wood Preservative Clear Wood Preservative
2. Then apply Wood [[Flat] [Semi-Gloss] [Gloss]] Acrylic paint system.

E. Gypsum Board - Flat – Acrylic		
1. Primer, 1 Coat	6000	W102
2. 2 Coats. Finish	6100	W402
F. Gypsum Board – Semi Gloss – Acrylic		
1. Primer, 1 Coat	6000	W101V
2. Finish, 2 Coats	6400	W7500

G. Exterior roof sheet metal flashings, Total 5.0 to 8.5 mil thickness, as recommended by the manufacturer:

	PPG	Tnemec	Sherwin Williams	Vista/Carboline/Rusto
H. Unprimed or shop primed - Ferrous - Semi Gloss - Polyurethane				
1. Primer, 1 Coat	Carboguard 890VOC	L69 [135]	B58-600S	S30 Griptec
2. Finish, 2 Coats	Carbothane 134VOC	1081[1077]	B65-300	Metalmax S37
I. Galvanized or Aluminum - Semi Gloss - Polyurethane				
1. Primer, 1 Coat	Carboguard 890VOC	L69 [N69]	B58-600S	S30 Griptec
2. Finish, 2 Coats	Carbothane 134VOC	1081 [1077]	B65-300	Metalmax

J. Unprimed Metal, Surface Preparation: SSPC-SP 3, Power Tool Cleaning

K. Galvanized Metal, Surface Preparation: SSPC-SP1, Solvent Wash, and etch with one of the following.
   1. Sherwin-Williams B71Y1,
   2. Dunn Edwards, Galva-Etch (GE 123),
   3. JASCO Metal Etch
   4. Or equal

L. Aluminum Surface Preparation: SSPC-SP1, Solvent Wash, then apply Dunn Edwards, QD 43-7, or equal.

3.09 COLOR SCHEDULE

A. The District's standard for paint colors and materials based upon following:
   1. Paint: All exterior paint shall be semi-gloss, interior paint in the restrooms, kitchens, classrooms and utility areas shall be semi-gloss.
      a. Paint shall be 100% acrylic, equivalent to ICI Dulux, Vista, Dunn-Edwards.
   2. Paint manufacturer shall be Dunn-Edwards, ICU Dulux, Spectra-Tone or Vista.
      a. Exterior wall color to be Vista Paint Acriglo Semigloss "SBCUSD Hickory".
      b. Exterior door color to be Vista Paint Acriglo Semigloss "SBCUSD Burgundy".
      c. Exterior Trim color to be Vista Paint Acriglo Semigloss "SBCUSD Acorn".
      d. Overhang color to Vista Paint Acriglo Semigloss "SBCUSD Antique White".
      e. Interior wall color to be Vista Paint Acriglo Semigloss "SBCUSD Antique White".

END OF SECTION

SECTION 10 14 00
IDENTIFICATION SIGNS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Plastic Signs, raised character, tactile, room identification, and non-tactile signs.

B. Path of Travel (POT) signs.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)
   1. ASTM D4802 - Poly (Methyl Methacrylate) Acrylic Plastic Sheet

a. ADA – Americans with Disabilities Act of 1990
   1. ADA/UFAS – ADA Title II Regulations and the [Uniform Federal Accessibility Standards (UFAS)

B. CACRM - California Access Compliance Reference Manual, latest updates and based on the 2007 California Building Code.

C. CBC - 2007 California Building Code (CBC)
   1. CBC 10 - Chapter 10, Egress Requirements
   2. CBC 11B – Chapter 11B, Accessibility for Public Buildings, Public Accommodations, Commercial Facilities and Publicly Funded Housing

D. California Code of Regulations (CCR)
   1. CCR 19-3 - Title 19, Chapter 3

E. ASTM D4802 - Poly (Methyl Methacrylate) Acrylic Plastic Sheet.

1.03 SUBMITTALS

A. Shop Drawings of each sign, indicating lettering styles and locations and overall dimensions.

B. Three sample, full size, signs, [with different messages] of types, styles and colors specified including method of mounting. If accepted, samples may be installed in Project.

C. Manufacturer's Installation Instructions

D. Lettering Samples: 1-inch high, uppercase X, I, and O letters in each font specified, for required Quality Assurance testing.

E. Letter Proportion Templates
   1. One 1- by 1-inch (1:1) square.
   2. One a 1-inch high by 0.6-inch wide (3:5) rectangle.

3. One 1-inch high by 0.2-inch wide (5:1) rectangle.
4. One 1-inch high by 0.1-inch wide (10:1) rectangle.

1.04 QUALITY ASSURANCE

A. Regulatory Requirements
1. Tactile Signs shall conform to 2007 CBC Sections 1114B, 1117B.5, and 1143A and CACRM for accessibility requirements.

B. Tactile Character Requirements:
1. Character Type: Letters and numbers shall be raised characters (minimum 1/32 inch), in a sans-serif (without serif) font, printed in all uppercase, and accompanied by equivalent text in California Contracted Grade 2 Braille.
2. Character Size. Letters, numbers, and symbols shall be between 5/8-inch and 2-inches high.
3. Character Proportions. Letters and numbers shall have width-to-height ratio of between 3:5 and 1:1 and a stroke-width -to- character-height ratio between 1:10 and 1:5.
4. Place the 1:1 square template over the X and then the O; if either character is wider than the template, the font fails the test. Place the 3:5 rectangle template over the X and then the O; if either character is narrower than the template, the font fails the test. Place the 1:5 template over the I; if the character is wider than the template, the font fails the test. Place the 1:10 template over the I; if the character is narrower than the template, the font fails the test.
   a. If the font fails any test, the font will be rejected.
5. Finish. Alpha-numeric characters, symbols, and their background shall have a non-glare finish.
6. Contrast. Gray-value contrast between alpha-numeric characters and symbols and their background shall be 70-percent, minimum. Sign may be either light characters on a dark background or dark characters on a light background.
7. Braille
   a. Print the Braille equivalent messages in California Contracted Grade 2, Braille.
   b. 6 dots (2 columns of 3 dots) form a cell. Dots shall be 1/10 inch (2.54 mm) on-center each way in a cell. Dots shall be raised a minimum of 1/40 inch (0.635 mm) above the background (CBC 1117B.5.6) and shall be rounded or domed California Braille dots, each distinct and separate.
   c. Provide 2/10-inch (5.08mm) space between cells, measured from the trailing edge of the second column of dots in the preceding cell to the leading edge of the first column of dots in the succeeding cell.
8. Pictograms shall be accompanied by equivalent verbal description directly below.
9. International Symbol of Accessibility: conform to CBC Sections 1117B.5.8 and 1117B.5.2 and the proportions indicated in the ADA Standards/UFAS. Provide white figure on Federal Standard No.15090, color 595B (blue) background unless another color combination is expressly approved by DSA.

C. Pre-Installation Conference
   1. Notify Architect when signs are ready for installation. Arrange for conference at site. Do not proceed with installation until Architect's approval of specific locations and methods of attachment has been obtained.
   2. Provide signs from one manufacturer, unless otherwise approved.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver products to site and protect from damage. Store until immediately prior to Notice of Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products of following manufacturers form basis for design and quality intended.
   1. ASI Sign Systems.
   2. Vomar Products.
   3. Sign Arts Company.

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

2.02 PLASTIC SIGN MATERIALS

A. Tactile Plastic Sign Materials: Thermosetting high pressure laminate.

B. Non-Tactile Signs: Cast Acrylic Plastic Sheet; ASTM D4802, Category A-1, 1/4 inch overall thickness, laminated acrylic plastic sheets.

2.03 SIGN FABRICATION - GENERAL

A. Plastic Signs
   1. Tactile Plastic Signs using Graphic Process Sand-Carved signs, with radius corners, and square cut edges, exterior-grade. Graphics, Braille and tactile copy required.
      a. Unframed Signs: Custom copy by Architect.
   2. Non-tactile Plastic Signs: 1/4 inch overall thickness, laminated acrylic plastic sheets, using sub-surface screen-print process graphics and symbols, exterior-grade at exterior locations, 3/8-inch square corners, square cut edge, drilled holes for countersunk screws, polished edges.
      a. Unframed Signs.
   3. Colors:
      a. Field Colors: Match Paint Dunn Edwards Norfolk Brown #79.
      b. Font Colors: Match Dunn Edwards Bond White #SP-427.
   4. Apply UV inhibitor overcoat for exterior signs.

B. Fasteners: Stainless steel screws, flat head, pin-in-head torx screws for vandal-proof and clear silicone adhesive.

C. Lettering Type Style: Helvetica Regular, uppercase letters only, refer to QUALITY ASSURANCE for letter-proportion compliance.

2.04 ROOM IDENTIFICATION SIGNS

A. Room Identification Signs: raised character, tactile plastic signs, Colors: Refer to Paragraph 2.03.A.3.
   1. ADA Tactile and Braille Signs: Thermosetting high pressure laminate using Graphic Process Sand-Carved signs.
   2. Non-Tactile Signs: Acrylic Plastic Sheet: ASTM D4802.

B. Size: 2 inches high, minimum, by 8 inches long, with 1 inch high surface applied letters, minimum 1/32 inch thick, fully tactile, with BRAILLE indicator.
   1. Provide one sign with up to 13 letters for each door.
   2. Provide one sign with up to 3 numerals for each door.

C. Lettering Type Style: Helvetica Medium.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive Work.

B. Beginning of installation means installer accepts existing surfaces.

3.02 INSTALLATION

A. Install signs only after surfaces are finished, install at all rooms.
   1. At single-leaf doors, locate signs on wall adjacent to latch side of applicable door opening, centered horizontally within 18-inch space adjacent to latch side of door, 60 inches from finish floor to center line of sign. Mounting location shall be determined so that person may approach within 3 inches of sign without encountering protruding objects or standing within swing of door. At pairs of doors, locate sign on nearest adjacent wall, outside door swing area.

B. Mounting
   1. Tactile Plastic Signs: Concealed mounting, stainless steel screws, pin torx, vandal-proof.
   2. Non-tactile Plastic Signs:
      a. Install with four (4) stainless steel countersunk flathead screws, pin torx, vandal-proof. Pre-drill holes to prevent breaking plastic, use countersunk drill bits to flush screw head with sign surface.

C. For signs installed on glass: a blank glass back up is required to be placed on opposite side of glass exactly behind sign being installed. This blank glass back up is to be the same size as sign being installed.

END OF SECTION

SECTION 10 14 33

EXIT SIGNAGE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Photoluminescent Exit Signage.

B. Photoluminescent Tactile Exit Signs.

1.02 REFERENCES

A. ADA – Americans with Disabilities Act of 1990
   1. ADA/UFAS – ADA Title II Regulations and the Uniform Federal Accessibility Standards (UFAS).

B. CACRM - California Access Compliance Reference Manual, latest updates.

1.03 SUBMITTALS

A. Shop drawings listing sign styles, lettering and locations and overall dimensions of each sign.

B. Two samples illustrating full size sample sign, of type, style and color specified including method of attachment. If accepted, samples may be installed in project.

C. Manufacturer's installation instructions.

1.04 QUALITY ASSURANCE

A. Regulatory Requirements for Exit Signs
   1. Conform to CACRM for accessibility provisions.
   2. Signage Requirements
      a. Proportions: Letters and numbers shall have width-to-height ratio of between 3:5 and 1:1 and stroke width-to-height of between 1:10 and 1:5, 1117B.5.3.
         All letters measured must be uppercase. After choosing typestyle to test, begin by printing the letters I, X, and O at 1 inch height. Place template's 1:1 square over the X or O, whichever is narrower. If the character is not wider than 1 inch, or narrower than the 3:5 rectangle, the proportions are correct. Use the 1:5 rectangle to determine if the stroke of the I is too broad, and the 1:10 rectangle to see if it is too narrow. If all the tests are passed, the typestyle is compliant with proportion code.
      b. Finish and contrast: Characters, symbols and their background shall have a non-glare finish. Characters and symbols shall contrast with their background, 70% minimum, either light characters on a dark background or dark characters on a light background, 1117B5.2.

c. Characters and symbols shall contrast in color or image with either light letters on dark background or dark letters on light background, and shall be raised minimum 1/32 inch.
d. Minimum height for raised characters or symbols: 5/8 inch minimum and 2 inches maximum, uppercase.

B. Pre-installation Conference: Notify Architect when signs are ready for installation. Arrange for conference at site. Do not proceed with installation until Architect's approval of specific locations and methods of attachment has been obtained.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver products to site and protect from damage. Store until immediately prior to Notice of Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products of following manufacturers form basis for design and quality intended.
1. Active Safety, Murray, UT.
2. Self-Powered Lighting Inc., Berwyn, PA.
3. Isolite Corporation, San Luis Obispo, CA.

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

2.02 EMERGENCY EXIT SIGNS

A. Self-Illuminating Exit Signs: UL Listed, Minimum luminance, 0.06 foot lambert.
1. Surface Mounted Wall Signs:
a. Low Level Exit Signs - Wall: Series 2002, Standard Configuration, Green illuminating letters, stenciled brush aluminum face plate with PHOTO-LUMINESCENT TEXT. Finish: brushed aluminum, 8 by 15 inches, single face, one type of sign at each exit door.
b. High Level Exit Signs - End Wall Mounted: Series 2002, Standard Configuration, Green illuminating letters, stenciled brush aluminum [stainless steel] face plate with PHOTO-LUMINESCENT TEXT. Finish: brush aluminum, 8 by 15 inches, single face at exit doors, one type of sign at each exit door. Double face at corridors with pop out chevron arrows.

2.03 SELF-ILLUMINATING TACTILE EXIT SIGNS

A. Conform to Sections 1011 CBC, California Access Regulations (CACRM) and Policy Number 98-06.
1. Mfg: By Emedco, Buffalo, NY; All State Sign and Plague, Deer Park, NY. Or equal.
2. Model: GloBrite Braille Interior Signs; GBR20 and GBR21, Acrylic, 6" x 9", Color: RED/GLO. Modify wording per requirements below and Quality Assurance Article in Part 1 of this Section.

B. Install sign at each exit door as conditions required in Section 1011.3 CBC and CACRM.
   1. Each grade-level exterior exit door, with the word: "EXIT".
   2. Each grade-level exterior exit door exit enclosure/passageway with the words: "EXIT ROUTE".
   3. Each exit door from interior to corridor/passageway: "EXIT ROUTE"
   4. Each exit door through horizontal exit: "TO EXIT".
   5. At stairs with the words: "EXIT STAIR DOWN" or "EXIT STAIR UP".

C. At ramps with the words: "EXIT RAMP DOWN" or "EXIT RAMPUP.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work.

B. Beginning of installation means installer accepts existing surfaces.

3.02 INSTALLATION

A. Install signs only after surfaces are finished at exit locations.

B. Installation:
   1. Concealed mounting: Install with manufacturer's attachment.
   2. Exposed mounting: Install with minimum four (4) stainless steel countersunk flathead screws, tamper-proof.

C. Low and High level mountings as indicated on Drawings and comply with requirements of Section 1011.6 CBC.
   1. Low level signs: Install not less than 6 inches or more than 8 inches above finish floor to the bottom of sign. Install the closest edge of sign within 4 inches of door frame.

D. Clean and polish.

END OF SECTION

SECTION 23 05 00

BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Sleeves.
5. Escutcheons.
6. Grout.
7. Mechanical demolition.
8. Equipment installation requirements common to equipment sections.
9. Concrete bases.
10. Supports and anchorages.

1.2 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.3 SUBMITTALS

A. Welding certificates.

B. Provide 2 sets of reproducible vellum "Record Set As-Builts".

C. Provide 1 set of AutoCad disc (latest version) at completion with as-builts.

1.4 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.2 JOINING MATERIALS

A. Refer to individual Division 23 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

D. Brazing Filler Metals: AWS A5.8, BCuP Series or BAg1, unless otherwise indicated.

E. Welding Filler Metals: Comply with AWS D10.12.

2.3 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

F. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

2.4 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

B. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

C. Pressure Plates: Plastic. Include two for each sealing element.

D. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.5 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral water stop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

2.6 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.

1. Finish: Polished chrome-plated.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome-plated.

2.7 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors.

M. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

N. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

O. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

P. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 7 Section "Through-Penetration Firestop Systems" for materials.

Q. Verify final equipment locations for roughing-in.

R. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.3 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.5 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section.

3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 5 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.7 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor mechanical materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.8 GROUTING

A. Mix and install grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION

SECTION 23 05 13

MOTORS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes basic requirements for factory installed motors.

B. See Division 23 Section "Mechanical Vibration and Seismic Controls" for mounting motors and vibration isolation and seismic-control devices.

C. See individual Sections for application of motors and reference to specific motor requirements for motor-driven equipment.

1.2 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices and features that comply with the following:

1. Compatible with the following:

   a. Magnetic controllers.
   b. Multispeed controllers.
   c. Reduced-voltage controllers.

2. Designed and labeled for use with variable frequency controllers, and suitable for use throughout speed range without overheating.
3. Matched to torque and horsepower requirements of the load.
4. Matched to ratings and characteristics of supply circuit and required control sequence.

B. Coordinate motor support with requirements for driven load; access for maintenance and motor replacement; installation of accessories, belts, belt guards; and adjustment of sliding rails for belt tensioning.

PART 2 - PRODUCTS

2.1 MOTOR REQUIREMENTS

A. Motor requirements apply to factory installed motors except as follows:

1. Different ratings, performance, or characteristics for motor are specified in another Section.
2. Motorized-equipment manufacturer requires ratings, performance, or characteristics, other than those specified in this Section, to meet performance specified.

2.2 MOTOR CHARACTERISTICS

A. Motors 3/4 HP and Larger: Three phase.

B. Motors 1/2 HP and Smaller: Single phase.

C. Frequency Rating: 60 Hz.

D. Voltage Rating: NEMA standard voltage selected to operate on nominal circuit voltage to which motor is connected.

E. Service Factor: 1.15 for open dripproof motors; 1.0 for totally enclosed motors.

F. Duty: Continuous duty at ambient temperature of 105 deg F and at altitude of 3300 feet above sea level.

G. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

H. Enclosure: Open dripproof.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Premium, as defined in NEMA MG 1.

C. Stator: Copper windings, unless otherwise indicated.

1. Multispeed motors shall have separate winding for each speed.

D. Rotor: Squirrel cage, unless otherwise indicated.

E. Bearings: Double-shielded, prelubricated ball bearings suitable for radial and thrust loading.

F. Temperature Rise: Match insulation rating, unless otherwise indicated.

G. Insulation: Class F, unless otherwise indicated.

H. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.

I. Enclosure: Cast iron for motors 7.5 hp and larger; rolled steel for motors smaller than 7.5 hp.

1. Finish: Enamel.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Inrush Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Designed with critical vibration frequencies outside operating range of controller output.
2. Temperature Rise: Matched to rating for Class B insulation.
3. Insulation: Class H.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

2.5 SINGLE-PHASE MOTORS

A. Type: One of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split-phase start, capacitor run.
3. Capacitor start, capacitor run.

B. Shaded-Pole Motors: For motors 1/20 hp and smaller only.

C. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

D. Bearings: Ball type for belt-connected motors and other motors with high radial forces on motor shaft; sealed, prelubricated-sleeve type for other single-phase motors.

END OF SECTION

SECTION 23 05 29

HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes hangers and supports for mechanical system piping and equipment.

B. See Division 23 Section "Mechanical Vibration and Seismic Controls" for vibration isolation supports and hangers and seismic restraints.

1.2 DEFINITIONS

1.3 PERFORMANCE REQUIREMENTS

A. Design channel support systems for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water per SMACNA Standards.

B. Design heavy-duty steel trapezes for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water per SMACNA Standards .

C. Design seismic-restraint hangers and supports for piping and equipment per SMACNA Standards.

D. Design and obtain approval from authorities having jurisdiction for seismic-restraint hangers and supports for piping and equipment per SMACNA Standards.

1.4 SUBMITTALS

A. Product Data: For each type of pipe hanger, channel support system component, and thermal-hanger shield insert indicated.

B. Shop Drawings: Signed and sealed by a qualified professional engineer for multiple piping supports and trapeze hangers. Include design calculations and indicate size and characteristics of components and fabrication details.

C. Welding certificates.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

B. Engineering Responsibility: Design and preparation of Shop Drawings and calculations for each multiple pipe support and seismic restraint by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 MANUFACTURED UNITS

A. Pipe Hangers, Supports, and Components: MSS SP-58, factory-fabricated components.

1. Manufacturers:

   a. B-Line Systems, Inc.
   b. Fee and Mason.
   c. Grinnell Corp.
   d. Midland-Ross Corp. – Superstrut.
   e. Michigan Hanger Co., Inc.
   f. Unistrut.

2. Galvanized, Metallic Coatings: For piping and equipment that will not have field-applied finish.
3. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

B. Channel Support Systems: MFMA-2, factory-fabricated components for field assembly.

1. Manufacturers:

   a. B-Line Systems, Inc.
   b. Grinnell Corp.
   c. Michigan Hanger Co., Inc.
   d. Midland-Ross Corp. – Superstrut.

e. Unistrut Corp.

2. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
3. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

C. Thermal-Hanger Shield Inserts: 100-psi minimum compressive-strength insulation, encased in sheet metal shield.

1. Manufacturers:

a. Midland-Ross Corp. – Superstrut.
b. Michigan Hanger Co., Inc.
c. Elcen Metal Products.
d. Pipe Shields, Inc.
e. Rilco Manufacturing Co., Inc.
f. KM-Line.

2. Material for Cold Piping: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate with vapor barrier.
3. Material for Hot Piping: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate.
4. For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.
5. For Clevis or Band Hanger: Insert and shield cover lower 180 deg rees of pipe.
6. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.3 MISCELLANEOUS MATERIALS

A. Powder-Actuated Drive-Pin Fasteners: Powder-actuated-type, drive-pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

C. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized.

D. Grout: ASTM C 1107, Grade B, factory-mixed and -packaged, nonshrink and nonmetallic, dry, hydraulic-cement grout.

1. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
2. Properties: Nonstaining, noncorrosive, and nongaseous.
3. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Specific hanger requirements are specified in Sections specifying equipment and systems.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Specification Sections.

C. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
4. Adjustable Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
5. U-Bolts (MSS Type 24): For support of heavy pipe, NPS 1/2 to NPS 30.
6. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
7. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from 2 rods if longitudinal movement caused by expansion and contraction might occur.
8. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

D. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.

E. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.

F. Building Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

G. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe, 360-deg ree insert of high-density, 100-psi minimum compressive-strength, water-repellent-treated calcium silicate or cellular-glass pipe insulation, same thickness as adjoining insulation with vapor barrier and encased in 360-degree sheet metal shield.

H. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.

3.2 INSTALLATION

A. Pipe Hanger and Support Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems. Field assemble and install according to manufacturer's written instructions.

C. Heavy-Duty Steel Trapeze Installation: Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated, heavy-duty trapezes. Support pipes of various sizes together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

D. Install building attachments within concrete slabs or attach to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

E. Install powder-actuated drive-pin fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

F. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping," is not exceeded.

K. Insulated Piping: Comply with the following:

1. Attach clamps and spacers to piping.

a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.

b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
c. Do not exceed pipe stress limits according to ASME B31.9.

2. Install MSS SP-58, Type 39 protection saddles, if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span arc of 180 deg rees.
4. Shield Dimensions for Pipe: Not less than the following:

   a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
   b. NPS 4: 12 inches long and 0.06 inch thick.
   c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
   d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
   e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 and Larger: Include wood inserts.
6. Insert Material: Length at least as long as protective shield.
7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure above or to support equipment above floor. Place grout under supports for equipment and make smooth bearing surface.

3.4 METAL FABRICATION

A. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations. Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

   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. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.6 PAINTING

A. Touching Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils. See Division 9 Section 09911 Painting (Consumer Line Products) for paint materials and application requirements.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 23 05 48

MECHANICAL VIBRATION AND SEISMIC CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Freestanding and restrained spring isolators.
2. Thrust limits.
3. Seismic snubbers.

B. Definitions:

1. A_v: Effective peak velocity related acceleration coefficient.
2. OSHPD: Office of Statewide Health Planning & Development for the State of California. OSHPD assigns a unique anchorage preapproval "OPA" number to each seismic restraint it tests. The number describes a specific device applied as tested.

1.2 PERFORMANCE REQUIREMENTS

A. A_v: According to seismic code of governing jurisdiction.

B. Component Seismic Coefficient: Refer to equipment schedule for value for each piece of equipment.

C. Performance Criteria Factor: Refer to equipment schedule for value for each piece of equipment.

D. Attachment Amplification Factor: Refer to equipment schedule for value for each piece of equipment.

1.3 SUBMITTALS

A. Product Data: Include load deflection curves for each vibration isolation device indicated.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Include the following:

1. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.

2. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.
3. Seismic-Restraint Details: Detail fabrication and attachment of seismic restraints and snubbers. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.
4. Details for Interlocking Snubbers: Include load deflection curves up to 1/2-inch deflection in x, y, and z planes.

1.4 QUALITY ASSURANCE

A. Seismic-restraint devices shall have horizontal and vertical load testing and analysis performed according to OSHPD and shall bear anchorage preapproval "opa" number, from OSHPD or another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a registered professional engineer. Testing and calculations must include both shear and tensile loads and 1 test or analysis at 45 deg rees to the weakest mode.

B. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Manufacturers:

1. Mason Industries, Inc.
2. M.W. Sausse.

B. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch- thick, elastomeric isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.

5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.2 SEISMIC-RESTRAINT DEVICES

A. Manufacturers:

1. Mason Industries, Inc.
2. M.W. Sausse.

B. Resilient Isolation Washers and Bushings: 1-piece, molded, bridge-bearing neoprene complying with AASHTO M 251 and having a durometer of 50, plus or minus 5, with a flat washer face.

C. Seismic Snubbers: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.

1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
2. Resilient Isolation Washers and Bushings: 1-piece, molded, bridge-bearing neoprene complying with AASHTO M 251 and having a durometer of 50, plus or minus 5.

D. Anchor Bolts: Seismic-rated, drill-in, and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488/E 488M.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install roof curbs, equipment supports, and roof penetrations as specified in Division 7 Section "Roof Accessories."

B. Install thrust limits at centerline of thrust, symmetrical on either side of equipment.

C. Install seismic snubbers on isolated equipment. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.

D. Install steel angles or channel, sized to prevent buckling, clamped with ductile-iron clamps to hanger rods for trapeze and individual pipe hangers. At trapeze anchor locations, shackle piping to trapeze. Requirements apply equally to hanging equipment. Do not weld angles to rods.

E. Install resilient bolt isolation washers on equipment anchor bolts.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Inspect isolator seismic-restraint clearance.
2. Test isolator deflection.
3. Inspect minimum snubber clearances.

3.3 ADJUSTING

A. Adjust isolators after piping systems have been filled and equipment is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop.

D. Adjust active height of spring isolators.

E. Adjust snubbers according to manufacturer's written recommendations.

F. Adjust seismic restraints to permit free movement of equipment within normal mode of operation.

G. Torque anchor bolts according to equipment manufacturer's written recommendations to resist seismic forces.

3.4 VIBRATION ISOLATOR AND SEISMIC-RESTRAINT SCHEDULE

A. Supported Equipment: Rooftop A/C units Compressor/Condensor units, and utility fan.

1. Equipment Location: Roof.
2. Isolator Type: Spring.
3. Minimum Deflection: 1"
4. Base: Factory pitch to match roof slope. (For utility set fan: Rail set on level platform)

B. Suspended Equipment: Inline fans and fan coils.

1. Equipment Location: Suspended from roof structure.
2. Isolator Type: Spring.
3. Minimum Deflection: 1"

END OF SECTION

SECTION 23 05 53

MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following mechanical identification materials and their installation:

1. Equipment nameplates.
2. Equipment markers.
3. Access panel and door markers.
4. Pipe markers.
5. Valve tags.
6. Valve schedules.
7. Warning tags.

1.3 SUBMITTALS

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

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Valve numbering scheme.

D. Valve Schedules: For each piping system. Furnish extra copies (in addition to mounted copies) to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

1.5 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with location of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT IDENTIFICATION DEVICES

A. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equipment.

1. Data:

   a. Manufacturer, product name, model number, and serial number.
   b. Capacity, operating and power characteristics, and essential data.
   c. Labels of tested compliances.

2. Location: Accessible and visible.
3. Fasteners: As required to mount on equipment.

B. Equipment Markers: Engraved, color-coded laminated plastic. Include contact-type, permanent adhesive.

1. Terminology: Match schedules as closely as possible.
2. Data:

   a. Tag as indicated on drawings.

3. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.

C. Access Panel and Door Markers: 1/16-inch- thick, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification. Provide 1/8-inch center hole for attachment.

1. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

2.2 PIPING IDENTIFICATION DEVICES

A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.

1. Colors: Comply with ASME A13.1, unless otherwise indicated.

2. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.
3. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers extending 360 degrees around pipe at each location.
4. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers at least three times letter height and of length required for label.
5. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.

B. Pretensioned Pipe Markers: Precoiled semirigid plastic formed to cover full circumference of pipe and to attach to pipe without adhesive.

C. Self-Adhesive Pipe Markers: Plastic with pressure-sensitive, permanent-type, self-adhesive back.

D. Plastic Tape: Continuously printed, vinyl tape at least 3 mils thick with pressure-sensitive, permanent-type, self-adhesive back.

1. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches: 3/4 inch minimum.
2. Width for Markers on Pipes with OD, Including Insulation, 6 Inches or Larger: 1-1/2 inches minimum.

2.3 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers, with numbering scheme approved by Architect. Provide 5/32-inch hole for fastener.

1. Material: 0.032-inch- thick brass.
2. Valve-Tag Fasteners: Brass wire-link or beaded chain; or S-hook .

2.4 VALVE SCHEDULES

A. Valve Schedules: For each piping system, on standard-size bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-Schedule Frames: Glazed display frame for removable mounting on masonry walls for each page of valve schedule. Include mounting screws.
2. Frame: Extruded aluminum.
3. Glazing: ASTM C 1036, Type I, Class 1, Glazing Quality B, 2.5-mm, single-thickness glass.

2.5 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags; of plasticized card stock with matte finish suitable for writing.

1. Size: 3 by 5-1/4 inches minimum.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.
4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 APPLICATIONS, GENERAL

A. Products specified are for applications referenced in other Division 23 Sections. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.

3.2 EQUIPMENT IDENTIFICATION

A. Install and permanently fasten equipment nameplates on each major item of mechanical equipment that does not have nameplate or has nameplate that is damaged or located where not easily visible. Locate nameplates where accessible and visible. Include nameplates for the following general categories of equipment:

1. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
2. Pumps, compressors, chillers, condensers, and similar motor-driven units.
3. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
4. Fans, blowers, primary balancing dampers, and terminal units.
5. Packaged HVAC central-station and zone-type units.

B. Install equipment markers with permanent adhesive on or near each major item of mechanical equipment.

1. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Lettering shall be minimum 2" high for outdoor equipment. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
2. Data: Tag as indicated on drawings.
3. Locate markers where accessible and visible. Include markers for the following general categories of equipment:

   a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.

b. Fire department hose valves and hose stations.
c. Meters, gages, thermometers, and similar units.
d. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
e. Pumps, compressors, chillers, condensers, and similar motor-driven units.
f. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
g. Fans, blowers, primary balancing dampers, and terminal units.
h. Packaged HVAC central-station and zone-type units.
i. Tanks and pressure vessels.
j. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.

C. Stenciled Equipment Marker Option: Stenciled markers may be provided instead of laminated-plastic equipment markers, at Installer's option, if lettering larger than 1 inch high is needed for proper identification because of distance from normal location of required identification.

D. Install access panel markers with screws on equipment access panels.

3.3 PIPING IDENTIFICATION

A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.
1. Pipes with OD, Including Insulation, Less Than 6 Inches: Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, 1-1/2 inches wide, lapped at least 1-1/2 inches at both ends of pipe marker, and covering full circumference of pipe.
2. Pipes with OD, Including Insulation, 6 Inches and Larger: Shaped pipe markers. Use size to match pipe and secure with fasteners.

B. Locate pipe markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior nonconcealed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and nonaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced markers.

3.4 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; plumbing fixture supply stops; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following:

1. Valve-Tag Size and Shape:

   a. 1 ½ ", round.

2. Valve-Tag Color:

   a. Natural.

3. Letter Color:

   a. Black.

3.5 VALVE-SCHEDULE INSTALLATION

A. Mount valve schedule on wall in accessible location in each major equipment room.

3.6 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

3.7 ADJUSTING

A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

3.8 CLEANING

A. Clean faces of mechanical identification devices and glass frames of valve schedules.

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes testing, adjusting, and balancing HVAC systems to produce design objectives, including the following:

1. Balancing airflow and water flow within distribution systems, including submains, branches, and terminals, to indicated quantities according to specified tolerances.
2. Laboratory fume hood airflow balancing.
3. Adjusting total HVAC systems to provide indicated quantities.
4. Measuring electrical performance of HVAC equipment.
5. Setting quantitative performance of HVAC equipment.
6. Verifying that automatic control devices are functioning properly.
7. Reporting results of activities and procedures specified in this Section.

1.2 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. AMCA: Air Movement and Control Association.

C. CTI: Cooling Tower Institute.

D. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

1.3 SUBMITTALS

A. Strategies and Procedures Plan: Testing, adjusting, and balancing strategies and step-by-step procedures. Include a complete set of report forms intended for use on this Project.

B. Certified Testing, Adjusting, and Balancing Reports: Prepared on approved forms certified by the testing, adjusting, and balancing Agent.

1.4 QUALITY ASSURANCE

A. Agent Qualifications: Engage a testing, adjusting, and balancing agent certified by AABC.

B. Certification of Testing, Adjusting, and Balancing Reports: Certify testing, adjusting, and balancing field data reports. This certification includes the following:

1. Review field data reports to validate accuracy of data and to prepare certified testing, adjusting, and balancing reports.
2. Certify that testing, adjusting, and balancing team complied with approved testing, adjusting, and balancing plan and procedures specified and referenced in this Specification.

C. Testing, Adjusting, and Balancing Reports: Use standard forms from AABC's "National Standards for Testing, Adjusting, and Balancing."

D. Instrumentation Type, Quantity, and Accuracy: As described in AABC national standards.

E. Instrumentation Calibration: Calibrate instruments at least every six months or more frequently if required by the instrument manufacturer.

1.5 PROJECT CONDITIONS

A. Partial Owner Occupancy: The Owner may occupy completed areas of the building before Substantial Completion. Cooperate with the Owner during testing, adjusting, and balancing operations to minimize conflicts with the Owner's operations.

1.6 COORDINATION

A. Coordinate efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist testing, adjusting, and balancing activities.

B. Perform testing, adjusting, and balancing after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.7 WARRANTY

A. National Project Performance Guarantee: Provide a guarantee on AABC'S "National Standards" forms stating that AABC will assist in completing the requirements of the Contract Documents if the testing, adjusting, and balancing Agent fails to comply with the Contract Documents. Guarantee includes the following provisions:

1. The certified Agent has tested and balanced systems according to the Contract Documents.
2. Systems are balanced to optimum performance capabilities within design and installation limits.

PART 2 - PRODUCTS

2.1 AABC Tab Agencies

A. Los Angeles Air Balance (909)593-0906.

B. American Air Balance (714) 693-3700

C. Penn Air Control (714) 220-9091

D. Other AABC member in good standing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with project requirements and to discover conditions in systems' designs that may preclude proper testing, adjusting, and balancing of systems and equipment.

1. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.

B. Examine approved submittal data of HVAC systems and equipment.

C. Examine Project Record Documents described in Division 1 Section "Project Record Documents."

D. Examine equipment performance data, including fan and pump curves. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from those presented when equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with design data and installed conditions.

E. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Specification Sections have been performed.

F. Examine system and equipment test reports.

G. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.

H. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.

I. Examine air-handling equipment to ensure clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

J. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

K. Examine equipment for installation and for properly operating safety interlocks and controls.

L. Examine automatic temperature system components to verify the following:

1. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in mixing boxes, variable-air-volume terminals and zone dampers.
2. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
3. Sensors are located to sense only intended conditions.
4. Sequence of operation for control modes is according to the Contract Documents.
5. Controller set points are set at design values. Observe and record system reactions to changes in conditions. Record default set points if different from design values.
6. Interlocked systems are operating.
7. Changeover from heating to cooling mode occurs according to design values.

M. Report deficiencies discovered before and during performance of testing, adjusting, and balancing procedures.

3.2 PREPARATION

A. Prepare a testing, adjusting, and balancing plan that includes strategies and step-by-step procedures.

B. Complete system readiness checks and prepare system readiness reports. Verify the following:

1. Permanent electrical power wiring is complete.
2. Hydronic systems are filled, clean, and free of air.
3. Automatic temperature-control systems are operational.
4. Equipment and duct access doors are securely closed.
5. Balance, smoke, and fire dampers are open.
6. Isolating and balancing valves are open and control valves are operational.
7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
8. Windows and doors can be closed so design conditions for system operations can be met.

3.3 TESTING AND BALANCING PROCEDURES

A. Perform testing and balancing procedures on each system according to procedures contained in AABC national standards.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to the insulation Specifications for this Project.

C. Mark equipment settings with paint or other suitable, permanent identification material, including damper-control positions, valve indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

3.4 PROCEDURES FOR LABORATORY FUME HOODS

A. Before performing laboratory fume hood testing, measure, adjust and record the supply airflow and airflow patterns of each supply air outlet that is located in the same room as the hood. Adjust the air outlet flow pattern to minimize turbulence and to achieve the desired airflow patterns at the face and inside the hood. Verify that adequate makeup air is available to achieve the indicated flow of the hood.

B. Measure, adjust, and record the airflow of each laboratory fume hood by duct Pitot-tube traverse with the laboratory fume hood sash in the design open position.

   1. For laboratory fume hoods installed in variable exhaust systems, measure, adjust, and record the hood exhaust airflow at maximum and at minimum airflow conditions.
   2. For laboratory fume hoods designed with integral makeup air, measure, adjust, and record the exhaust and makeup airflow.

C. For laboratory fume hoods that are connected to centralized exhaust systems using automatic dampers, adjust the damper controller to obtain the indicated exhaust airflow.

D. After balancing is complete, do the following:

   1. Measure and record the static pressure at the hood duct connection with the hood operating at indicated airflow.
   2. Measure and record the face velocity across the open sash face area. Measure the face velocity at each point in a grid pattern. Perform measurements at a maximum of 12 inches between points and between any point and the perimeter of the opening.

      a. For laboratory fume hoods designed to maintain a constant face velocity at varying sash positions, also measure and record the face velocity at 50 and 25 percent of the design open sash position.
      b. Calculate and report the average face velocity by averaging all velocity measurements.

c. Calculate and report the exhaust airflow by multiplying the calculated average face velocity by the sash open area. Compare this quantity with the exhaust airflow measured by duct Pitot-tube traverse. Report differences.
d. If the average face velocity is less than the indicated face velocity, retest the average face velocity and adjust hood baffles, fan drives, and other parts of the system to provide the indicated average face velocity.

3. Check each laboratory fume hood for the capture and containment of smoke by using a hand-held emitting device. Observe the capture and containment of smoke flow pattern across the open face and inside the hood. Make adjustments necessary to achieve the desired results.

E. With the room and laboratory fume hoods operating at indicated conditions, perform an "as-installed" performance test of the laboratory fume hood according to ASHRAE 110. Test each laboratory fume hood(s) and document the test results.

3.5 TOLERANCES

A. Set HVAC system airflow and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans: Plus 5 to plus 10 percent.
2. Air Outlets and Inlets: 0 to minus 10 percent.

3.6 REPORTS

A. Status Reports: As Work progresses, prepare reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

B. Final Report: Typewritten, or computer printout in letter-quality font, on standard bond paper, bound in three-ring, loose-leaf binder, and tabulated and divided into sections by tested and balanced systems.

1. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing agent.
2. Include a list of instruments used for procedures, along with proof of calibration.
3. Final Report Contents: In addition to certified field report data, include the following:

a. Fan curves.
b. Manufacturers' test data.
c. Field quality-control test reports prepared by system and equipment installers.
d. Other information relative to equipment performance, but do not include approved Shop Drawings and Product Data.

4. General Report Data: In addition to form titles and entries, include the following data in the final report, as applicable:

   a. Title page.
   b. Name and address of testing, adjusting, and balancing Agent.
   c. Project name.
   d. Project location.
   e. Architect's name and address.
   f. Engineer's name and address.
   g. Contractor's name and address.
   h. Report date.
   i. Signature of testing, adjusting, and balancing Agent who certifies the report.
   j. Summary of contents, including the following:

      1) Design versus final performance.
      2) Notable characteristics of systems.
      3) Description of system operation sequence if it varies from the Contract Documents.

   k. Nomenclature sheets for each item of equipment.
   l. Data for terminal units, including manufacturer, type size, and fittings.
   m. Notes to explain why certain final data in the body of reports vary from design values.
   n. Test conditions for fans and pump performance forms, including the following:

      1) Settings for outside-, return-, and exhaust-air dampers.
      2) Conditions of filters.
      3) Cooling coil, wet- and dry-bulb conditions.
      4) Face and bypass damper settings at coils.
      5) Fan drive settings, including settings and percentage of maximum pitch diameter.
      6) Inlet vane settings for variable-air-volume systems.
      7) Settings for supply-air, static-pressure controller.
      8) Other system operating conditions that affect performance.

5. System Diagrams: Include schematic layouts of air distribution systems. Present with single-line diagrams and include the following:

   a. Quantities of outside, supply, return, and exhaust airflows.
   b. Duct, outlet, and inlet sizes.
   c. Terminal units.
   d. Balancing stations.

3.7 FINAL INSPECTION

1. After initial inspection is complete and evidence by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Architect.

2. TAB firm test and balance engineer shall conduct the inspection in the presence of Owner.
3. Owner shall randomly select measurements documented in the final report to be rechecked. The rechecking shall be limited to either 10 percent of the total measurements recorded, or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If the rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
6. TAB firm shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes and resubmit the final report.
7. Request a second final inspection. If the second final inspection also fails, Owner shall contract the services of another TAB firm to complete the testing and balancing in accordance with the Contract Documents and deduct the cost of the services from the final payment.

3.8 ADDITIONAL TESTS

A. Within 90 days of completing testing, adjusting, and balancing, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial testing, adjusting, and balancing procedures were not performed during near-peak summer and winter conditions, perform additional inspections, testing, and adjusting during near-peak summer and winter conditions.

END OF SECTION

SECTION 23 07 13

INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes semi-rigid and flexible duct, insulating cements, field-applied jackets, AND accessories and attachments.

1.2 SUBMITTALS

A. Product Data: Thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.

B. Shop Drawings: Shop fabrication and installation details for the following:

1. Removable insulation sections at access panels.
2. Application of field-applied jackets.
3. Applications at linkages for control devices.

1.3 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide products with flame-spread and smoke-developed indices of 25 and 50, respectively, according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Mineral-Fiber Blanket Thermal Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II, without facing and with all-service jacket manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film.

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

a. Mineral-Fiber Insulation:

1. CertainTeed Manson.
2. Knauf FiberGlass GmbH.
3. Owens-Corning Fiberglas Corp.
4. Johns Manville International,Inc.

2. Accessories and Attachments:

   a. Bands: Aluminum 3/4 inch wide.
   b. Wire: 0.080-inch, nickel-copper alloy; 0.062-inch, soft-annealed, stainless steel; or 0.062-inch, soft-annealed, galvanized steel.
   c. Weld-Attached Anchor Pins and Washers: Copper-coated steel pin for capacitor-discharge welding and galvanized speed washer. Pin length sufficient for insulation thickness indicated.
   d. Adhesive-Attached Anchor Pins and Speed Washers: Galvanized steel plate, pin, and washer manufactured for attachment to duct and plenum with adhesive. Pin length sufficient for insulation thickness indicated.

B. Duct Liner- See "Metal Ducts" Section.

C. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials, with aluminum foil face (Outdoor), and FSK face (Indoor).

   1. Products:

      a. Aeroflex USA Inc.; Aerocel.
      b. Armacell LLC; AP Armaflex.
      c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.
      d. Imcoa

D. Mineral-Fiber, Preformed Pipe Insulation:

   1. Products:

      a. Johns Manville; Micro-Lok.
      b. Knauf Insulation; 1000(Pipe Insulation.
      c. Owens Corning; Fiberglas Pipe Insulation.

   2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

E. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied FSK jacket complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

   1. Products:

      a. CertainTeed Corp.; CrimpWrap.

b. Johns Manville; MicroFlex.
c. Knauf Insulation; Pipe and Tank Insulation.
d. Owens Corning; Fiberglas Pipe and Tank Insulation.

F. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is UL tested and certified to provide a 2 hour fire rating.

1. Products:

a. Certain Teed Corp.: FlameChek.
b. Johns Manville; Firetemp Wrap.
c. 3M; Fire Barrier Wrap Products.

PART 3 - EXECUTION

3.1 GENERAL APPLICATION REQUIREMENTS

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; and free of voids throughout the length of ducts and fittings.

C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.

E. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.

F. Apply insulation with the least number of joints practical.

G. Apply insulation over fittings and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated.

H. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic. Apply insulation continuously through hangers and around anchor attachments.

I. Insulation Terminations: For insulation application where vapor retarders are indicated, seal ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

J. Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.

K. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and partitions, except fire-rated walls and partitions.

L. Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire/smoke damper sleeves for fire-rated wall and partition penetrations.

M. Floor Penetrations: Terminate insulation at underside of floor assembly and at floor support at top of floor.

3.2 DUCT AND PLENUM APPLICATION SCHEDULE

A. Service: Supply-air, return-air, and outside-air ducts, located indoors, concealed.

1. Material: 1 ½ " thick Flexible fiberglass liner installed for first fifteen feet of ductwork at unit, followed by 2" thick Mineral-Fiber blanket wrap.
2. Minimum 6.0 installed R-Value.

B. Service: Refrigerant Piping.

1. Material: 1" thick flexible elastomeric.

C. Service: Grease Duct.

1. Material: Fire-Rated Blanket, thickness per manufacturer requirement for fire rating.

END OF SECTION

SECTION 23 09 00

ENERGY MANAGEMENT CONTROL SYSTEM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, include General and Supplementary Conditions and Division 1 Specifications, apply work to this section.

1.02 DESCRIPTION OF WORK

A. Work in this Section: Principal items include:

1. Energy Management Control System (EMCS) including sensors, switches, relays, thermostats, temperature control panels, and all other components for a complete and operable system.

2. Adjustment and Validation of Control System. Instruction of Owner's representative on the maintenance and operation of control equipment.

3. Interlock diagrams between equipment furnished under this and other sections and controls furnished herein .

4. Wiring and conduit. All low voltage wiring and conduit for the control system furnished and installed under Division 15; Power Wiring furnished and installed under Division 16.

B. This system shall be installed by mechanics and electricians regularly employed by a factory branch office or authorized licensee of the manufacturer.

1.03 RELATED SECTIONS

A. Refer to Division 16 sections for the following work; not work of this section:

1. Power wiring to power connection on EMCS System control panels and equipment control panels. Include starters, disconnects, and required electrical devices, except where specified as furnished, or factory-installed, by manufacturer.

1.04 QUALITY ASSURANCE

A. Codes and Standards:

1. General: The publications listed below form a part of this specification to the extent applicable:

a. ASHRAE Handbook of Fundamentals

b. National Standard Code for Information Interchange (ASCII), X3.64-1979

c. AT&T - Bell System Technical Reference for Data Communications Using Voiceband Private Line Channels; 41004-1975

d. EIT - Interface Between Data Terminal Equipment and Data Communications Equipment Employing Serial Binary Data Interchange; RS-232-69

e. EIA - Electrical Characteristics of Balanced Voltage Digital Interface Circuits; RS-485

f. NEMA - Enclosures for Electrical Equipment (1000 volts maximum); 250-1979

g. CEC - California Electrical Code

h. NFPA 90A - Air Conditioning and Ventilation Systems

1.05 SUBMITTALS

A. The contractor shall submit installation drawings, sequence of operation and catalog cut sheets for each device of the proposed system prior to installation for engineers approval. The drawings shall include the location and intercommunication of all stand-alone and subordinate control panels; the schematic diagrams of the controlled equipment with sensors and actuators shown interconnected to the system controllers; and logic diagrams that depict the sequence of operation.

B. After completion of the installation and commissioning of the system including final adjustments, a full set of as-built documentation shall be turned over to the Owner. The as-built shall include one (1) set of reproduceable drawings and two (2) copies of the database on flexible or removable hard disk for each stand-alone controller and the supervisory computer.

C. As-built documentation shall include diagrammatic layouts of the automatic control systems specified herein. Layouts shall show all control equipment, and the function of each item shall be indicted for the different seasons. Layouts shall be located in plastic protective folder and placed in the control panel.

D. All Drawings shall be accompanied with a complete description of sequence of operation. Each control element mentioned in the sequence description shall be identified with the same mark as shown on the control diagram.

E. Submittal of Materials:

1. Material submittals shall be manufacturer's prepared catalog cuts indicating type, size and technical details.

2. Reference catalog cuts to the applicable specification article (e.g. 2.02A).

3. Catalog cuts shall be submitted in complete groups of manufacturer's material.

4. Partial submittals of groups or systems are not applicable.

5. Verify that the submittal has been reviewed in detail and is in fact the Contractor's choice of materials.

1.06 WARRANTY

A. Provide all labor, material and equipment necessary to maintain beneficial performance of the entire Temperature Control System for a period of one (1) year after acceptance of the system, or parts thereof, by an authorized representative of the Owner. Any defects in workmanship or material during the warranty period shall be promptly corrected by the contractor at no charge to the Owner. All work shall be accomplished during normal working hours, Monday through Friday excluding legal holidays. Precaution shall be taken to minimize disruption of facility operations.

B. The following items shall be provided for the EMCS System in addition to Paragraph "A" under 1.07 Warranty.

1. A prepaid Warranty Service Agreement shall be turned over to the Owner at the time of the acceptance test as a prerequisite of system acceptance. The contract shall include the terms and conditions stated herein.

2. Service work shall be performed by service personnel in the direct employ of the controls contractors. The service technicians shall be factory trained and certified by the manufacturer to be competent in all aspects of the installed system. The technician shall have a working knowledge of calibration techniques, preventive maintenance, troubleshooting, software diagnosis and microprocessor repair.

3. Provide preventative maintenance at one (1) month intervals such that one twelfth of the system is tested and recommissioned if necessary at each monthly inspection. An Owner's representative shall certify that the monthly test has been conducted and the control system is functioning properly. A log of tasks performed at each test shall be maintained by the controls contractor and signed by the Owner as evidence of satisfactory completion of the Warranty Service Agreement. The log shall be retained on site and available for review by authorized personnel.

4. System modifications shall be incorporated into the as-built documentation and/or operator and maintenance manuals when operating parameters, control point settings or control strategies are changed. System modifications made by the user of the controls contractor shall have both party's approvals in order to maintain the Warranty Service Agreement. All database changes shall be saved on disk for backup to the system.

5. A software upgrade program shall be implemented on the anniversary or anniversaries of the warranty period. The upgrade shall provide all enhancements offered by the manufacturer for program in the accepted systems.

6. System enhancements beyond the scope of the project shall be field upgradable with pull-out/plug-in ease. Provided at reasonable value added cost these upgrades may be purchased at the Owner's option.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Carrier Energy Management Control System.
B. Honeywell.

2.02 DESCRIPTION

A. All controllers, relays, switches, and gauges, for equipment located within equipment rooms shall be mounted in enclosed control panels with hinged locking doors. All control devices for equipment located in exposed areas subject to outside weather conditions, shall be mounted inside weatherproof enclosures. Location of each panel is to be convenient for panel-mounted control devices describing the function of the device Nameplates shall be provided beneath each of the control devices for ease of identification.

B. All electrical devices within the panel shall be prewired to terminal strips with all inter-device wiring within the panel completed prior to installation of the system.

2.02 ENERGY MANAGEMENT CONTROL SYSTEM

A. General Description:

1. The Temperature Control System shall provide both monitoring and control of the building's mechanical and electrical systems for direct digital control of heating, ventilating and air conditioning equipment and facility management.

2. The system shall use fully distributed processing and be capable of performing all application routines and data storage as described herein without requiring an on-line central computer.

3. All devices shall be capable of operating as a stand-alone device controlling the desired functions of the heating and ventilating units. The thermostats shall software designed to control these pieces of equipment and shall be able to communicate on the network.

4. The system shall be fully automatic. All control functions shall be able to be performed without operator intervention.

5. The construction of the equipment, both physically and electronically, shall be modular in nature.

6. The system shall offer flexibility with regards to:

   System layout

   Placement of field sensors & control devices.

7. Provide a NEMA 1 steel key lockable cabinet as required to contain temperature controllers, relays, switches, and similar devices. Provide full-enclosure cabinets with painted finish. Cabinets shall be recessed type in all finished areas of

building. Cabinet shall be power ventilated by internal mounted fans to provide ambient temperature in the cabinet to insure proper operation of the controls.

8. Refer to Energy Management System Monitoring Points Schedule at end of this section for additional items to be furnished and installed such as sensors, relays, thermostats, motors, flow switches, etc.

B. System Hardware:

1. Monitor (TM01) Thermostat

a. Shall include an electronic control that shall determine the demand for heating or cooling based on the space demand.

b. Shall have the ability to operate the system fan either automatically, with the fan switch on AUTO (fan operation only during a system unoccupied heating or cooling mode), or continuously during the occupied mode with the fan switch set to ON. Fan operation during unoccupied mode shall be automatic. Switches shall be accessible and changeable remotely. System shall provide both commanded and actual fan status.

c. Shall have the ability to protect the system configuration from tampering and misuse by providing a minimum of four levels of security access into the thermostat control. Access levels shall range from allowing no configuration changes at the system control to allowing full configuration at the system control. Access levels within that range shall provide for user comfort adjustments of temperature and schedule of use.

d. Shall have the ability to automatically or manually change-over between heating and cooling.

e. Shall be capable of monitoring supply air temperature and utilizing this information as a safety device to de-energize stages of heating or cooling when adjustable equipment temperature limits are exceeded. Individual configurable temperature values for first and second stage both heating and cooling limits shall be selectable.

f. Shall include the capability to prevent unnecessary operation of second stage when on-board trending indicates that first stage can satisfy space demand.

g. The control system shall provide protection from the unit being intermittently sequenced from heating to cooling until the Time Guard time period has elapsed. This time period shall be a minimum of five minutes and shall vary with control system thermostat identification number or address. An integral override feature shall be provided to allow service troubleshooting to be performed without waiting for the Time Guard interval.

h. The system shall provide adjustable minimum run times for both heat and cool. It shall also provide adjustable minimum run times within either cool or heat modes.

i. Shall be capable of receiving and broadcasting outside air temperature information to the network communication bus.

j. Shall have the ability of establishing separate adjustable heating and cooling lockout temperatures based on outside air temperature. These temperatures

shall be individually configurable and will prevent unnecessary operation of heating/cooling within the bounds of the lockout temperatures.

k. Shall have the capability to alarm on adjustable unit discharge temperature for both heat and cool.

l. Shall have the capability to provide for unit reset when required for servicing the equipment.

m. The control system shall have the ability to automatically stagger multiple unit start times upon power-up after a power failure.

n. The unit control relay pack shall have outdoor duty rating, suitable for installation and operation in outdoor environments.

o. Calibration of the system sensors shall be adjustable from the monitor thermostat without requiring the sensor to be taken out of service.

p. Shall have an on-board timeclock capable of broadcasting to the network. It shall be capable of receiving time broadcasts from other network products. The clock shall support 365 day scheduling, with integral Daylight Savings and leap-year capability. The timeclock shall be adjustable in one minute increments, and shall have the capability of being taken "off-line" either locally or remotely via software. Shall be capable of 18 holiday schedules with up to 99 days per holiday schedule.

q. Shall be capable of establishing, adjusting and storing both an occupied and unoccupied program format on a daily basis. Scheduling increments shall be in 1 minute sectors, with eight program periods available.

r. Shall be capable of either following its own program schedules for occupied and unoccupied operation or following the program schedule of another device on the network communication bus.

s. Shall have integral unoccupied override capability to provide up to 2 hours of additional occupied operation without additional programming.

t. Shall have an LCD display capable of displaying separate heating and cooling setpoints and additional diagnostic information. Such information shall include: current system mode, time of day, security access level, space temperature, supply air temperature, outside air temperature, relative humidity, fan status and filter status.

u. Shall be capable of displaying temperature information in Fahrenheit or Celsius temperature scales in increments of one tenth of a degree. The capability shall be provided to display space temperature and set points on a rotating basis.

v. Shall include an adjustable set point limiting feature to allow a high and low range limit on heating and cooling set points.

w. Shall have an on-board space temperature sensor. The TEMP monitor thermostat shall also be capable of remote space sensing from a location away from the TEMP monitor thermostat when using a Remote Room Sensor. Capability shall be provided to read space temperature separately from the local TEMP monitor thermostat, from the Remote Room Sensor or to read an average from the local and up to 4 Remote Room Sensors.

x. Shall include the ability to display system diagnostics to indicate system operation, operating alarms, or service requirements. Alarms shall include: fan

status, filter status, unit supply air temperature both heating and cooling, space temp and network communication errors.

y. Shall include an integral zone usage meter to read and store, in minutes: amount of time zone demand matches the System Mode, or amount of time the zone is in Override, or the amount of time the zone demand matches the System Mode during Unoccupied Override.

2. Field Installed Controller (1600)

a. The Field Installed No. 1600 Comfort Controller shall be a sixteen bit micro-controller with pre-tested and factory configured software specifically designed for regulating building equipment using closed-loop Direct Digital Control and facility management routines.

b. The 1600 shall be located where shown on the plans and shall include inherent input/output capacity. Each 1600 shall include a minimum of eight inputs and eight outputs. The 1600 module shall include the ability to support a combination of universal HVAC sensor input and output types. The 1600 modules shall include the inherent ability to support any combination of discrete, 0-10vdc and 4-20ma outputs and the following sensor inputs types as a minimum:

Dry contact and pulsing dry contacts
0-10vdc and 4-20ma
5k and 10k thermistors

c. All output channels shall include diagnostic LED's. Whenever a discrete output has been enabled by the 1600, an LED associated with that channel shall light up.

d. When used with analog output points the LED will indicate the commanded position by dimming and brightening of the LED. When the output is commanded to its minimum position the LED will become dim. As the analog output command position increases, the brightness of the LED will increase, until it is fully illuminated at the maximum command output.

e. Each input and output channel shall include a configuration switch such that the user shall be able to select the input or output type from any of the types listed above. The 1600 shall not require wiring to terminal strip. The 1600 module shall utilize "plug type" terminals such that the user may be able to disconnect and replace a module simply by removing the plug type connectors and plugging them into a new module.

f. The controller shall be powered from standard, off the shelf, Class II, 24 volt transformers. The controller shall be listed under UL916-PAZX (Energy Management), UL 864-UDTZ (General Utility Signaling), VDE, and CSA. Products shall be manufactured in a facility have a Quality System that is registered to either ISO 9002 or ISO 9001 Quality Assurance Standard. The controller shall be designed to be easily mounted in a standard NEMA 1 type enclosure without special rails or mounting hardware and as local and national code dictates.

g. The controller shall include a 365 day real time clock and watchdog timer diagnostic indicator provided by a LED. The watchdog timer shall reset upon power on and be resettable by software thereafter. Should the watchdog timer not be resettable during the timing period, it shall time out and set all outputs to their non-powered state, and restart the controller. Controller shall include a minimum of 50 individual programmable Holiday periods.

h. The controller shall not require a battery. All configuration data, custom programs, etc., will be stored in non-volatile memory. The controller shall provide a minimum of two days data retention for the time clock and consumable date (run times, GPM, KWH, etc. Systems that require a battery to store date is not acceptable.

i. Provide a controller based, user-friendly interactive, programming language for the purpose of creating custom programs for specific, unique applications. Complex control strategies shall be able to be developed by the end user. All custom programming must be performed in English language commands, and all inputs, outputs, variables and flags shall be addressable by user specific English names without requiring alphanumeric addresses or point numbers. Programming languages such as BASIC or FORTRAN shall not be acceptable for these applications, and the custom programs shall be retained in controller memory and shall not require a host CPU to operate correctly. Custom programs shall be capable of supporting either SI metric or customary US units. All custom programming point data shall be capable of being transferred from one controller to another (if networked) directly without an on-line CPU or host computer.

j. The communications Bus shall be a three-conductor cable with shield. EIA Standard RS-485 Communications protocol shall be employed. The communications bus shall comply with FCC part 15, Subpart J, class A for bus radiated and conductive noise.

k. Communications Bus shall be capable of having multiple system elements connected. Communications Bus shall allow for the use of modules as an interface to secondary Buses.

3. Local Interface Device (LID)

a. Shall contain a keypad with 7 function keys, 4 operative keys, 12 numeric keys and a two line backlit, alphanumeric liquid crystal display (LCD). Each line on the LCD can display up to 24 characters.

b. Shall view the configuration of items, such as points and algorithms in both the status (maintenance) and edit modes.

c. Shall view and modify all configuration data, including time and setpoint schedules.

d. Shall view and override input/output points.

e. Shall view software points.

f. Shall be able to force a point and return it to automatic control.

g. Shall set the time and date of the network.

h. Shall access alarm history and point trace functions.

i. Shall access information such as bus number and system element number, baud rate, serial number.

4. Telink - Communications Device

a. An Telink shall be configured to send certain alarms to the CCN that will cause the Telink to initiate a call to another site automatically. The alarms can then be reported to a Comfort Works at the second site.

b. The Telink consists of a CCN CIO module equipped with software that enables it to perform its communications functions.

c. Depending on configuration, the Telink at the remote site may do one of the following:

d. require the operator to supply a password (Standard Mode)

e. require the operator to supply a number that corresponds to a telephone number stored in the remote Telink Gateway (Secured Mode)

5. NDS Bridge - Communications Extender

a. NDS/Bridge shall be used to provide a secondary bus primarily when a CCN system requires more than the 239 system elements that can be connected to a primary bus. A NDS/Bridge connected as a system element on the primary bus supports a secondary bus that can accommodate up to 239 system elements.

2.03 SOFTWARE

A. General: Access capability to the system, whether local or remote, shall be accomplished using the Carrier System Software. Software access shall not require any changes or modifications to the EMS system monitor thermostat, or associated system sensors.

B. Information Retrieval: The software shall be capable of, but not limited to, listing all current system sensor readings, listing and modifying configuration parameters such as occupancy schedules, setpoints, alarm options, and temperature limits.

C. Access Levels: The software shall be capable of providing levels of access into the system from simple monitoring to full monitoring and modifying system configurations.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine areas and conditions which temperature control systems are to be installed.

Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to handler.

3.02 INSTALLATION OF TEMPERATURE CONTROL SYSTEMS

A. General: Install systems and materials in accordance with manufacturer's instructions and rough-in drawings, and details on drawings. Install electrical components and use electrical products complying with requirements of applicable Division-16 sections of these specifications. Mount controllers at convenient locations and heights.

B. Control Wiring: The term "control wiring" is defined to include providing of wire, conduit and miscellaneous materials as required for mounting and connecting electric control devices.

C Wiring System: Install complete control wiring system for temperature control systems. Conceal wiring, except in mechanical rooms and areas where other conduit and piping are exposed. Provide multi-conductor instrument harness (bundle) in place of single conductors where number of conductors can be run along common path. Fasten flexible conductors bridging cabinets and doors, neatly along hinge side, and protect against abrasion. Tie and support conductors neatly.

D. Number-code or color-code conductors, excluding those used for local individual room controls, appropriately for future identification and servicing of control system.

E. Wiring shall be installed per the requirements for low voltage control as specified in the electrical specifications. Local codes shall have jurisdiction.

F. Install all electronic wiring, 24 vdc or less in No. 20 AWG as a minimum. Provide shields as required by equipment manufacturer.

G. Space Thermostat and Sensor Locations: locate thermostats and sensors for room control as indicated on the drawings and as close to return register as practical. Coordinate thermostat locations with Owner and Engineer.

H. Local Control Panels: Mount all local control panels on the control drawings.

3.04 ADJUSTING AND CLEANING

A. Start-up: Start-up, test, and adjust electric control system in presence of manufacturer's authorized representative. Demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

B. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surface with manufacturer's touch-up paint.

C. Final Adjustment: After completion of installation, adjust thermostats, control valves, motors, and similar equipment provided as work of this section.

D. Final adjustment shall be performed by specially trained personnel in direct employ of manufacturer of primary temperature control system.

3.05 CLOSE OUT PROCEDURES

A. The controls contractor shall provide the Owner's system operations complete instructions for proper control of the system under all modes of operation. These modes include but are not limited to summer/winter, and occupied/unoccupied.

B. The instructions shall be conducted during normal working hours, Monday through Friday. The instructions shall consist of both classroom and hands-on training for (2) school personnel for a 1 week training course through the manufacturer. Also, training for (1) person at the site for 8 hours.

3.06 SYSTEM ACCEPTANCE

A. The system installation shall be complete in all respects and tested for proper operation prior to acceptance testing for the Owner's authorized representative. A letter shall be submitted to the engineer requesting system acceptance. This letter shall certify all controls are installed and the software programs have been completely exercised for proper equipment operation. Acceptance testing will commence at a mutually agreeable time within 30 calendar days of the request. When the system has been deemed satisfactory in whole or in part by the Owner's representative, the system will be accepted for beneficial use which will start the warranty period for the commissioned portion.

3.07 SEQUENCE OF OPERATION

A. Sequence of Operation:

1. Shop drawings on operations manual shall include a complete sequence of operation for "user-friendly" operation.

END OF SECTION

SECTION 23 31 13

METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes metal ducts for supply, return, outside, and exhaust air-distribution systems in pressure classes from minus 2- to plus 10-inch wg. Metal ducts include the following:

1. Rectangular ducts and fittings.
2. Single-wall, round spiral-seam ducts and formed fittings.
3. Double-wall, round spiral-seam ducts and formed fittings.
4. Duct liner.
5. Stainless steel
6. Black steel

B. Related Sections include the following:

1. Division 23 Section "Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 DEFINITIONS

A. FRP: Fiberglass-reinforced plastic.

B. NUSIG: National Uniform Seismic Installation Guidelines.

1.4 SYSTEM DESCRIPTION

A. Duct system design, as indicated, has been used to select size and type of air-moving and -distribution equipment and other air system components. Changes to layout or configuration of duct system must be specifically approved in writing by Architect. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.

1.5 SUBMITTALS

A. Shop Drawings: Drawn to 1/4 inch equals 1 foot scale. Show fabrication and installation details for metal ducts.

1. Air Handling and A/C systems; exhaust systems.
2. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
3. Duct layout indicating sizes and pressure classes.
4. Elevations of top and bottom of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Duct accessories, including access doors and panels.
12. Hangers and supports, including methods for duct and building attachment, vibration isolation, and seismic restraints.

B. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Ceiling suspension assembly members.
2. Other systems installed in same space as ducts.
3. Ceiling- and wall-mounting access doors and panels required to provide access to dampers and other operating devices.
4. Ceiling-mounting items, including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

C. Welding certificates.

D. Field quality-control test reports.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," for hangers and supports.

B. NFPA Compliance:

1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SHEET METAL MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, and duct construction methods, unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections material thickness shall be per CMC.

B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.

C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts.

D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

E. Stainless steel: ASTM A 480/A 480M, Type 304, and having a No. 2D finish for concealed ducts and for exposed ducts.

F. Black steel: Continuous welded joint, liquid tight, 16 gauge min.

2.3 DUCT LINER

A. Fibrous-Glass Liner: Comply with NFPA 90A or NFPA 90B and with NAIMA AH124.

1. Manufacturers:

   a. CertainTeed Corp.; Insulation Group.
   b. Johns Manville International, Inc.
   c. Knauf Fiber Glass.
   d. Owens Corning.

2. Materials: ASTM C 1071; surfaces exposed to airstream shall be coated to prevent erosion of glass fibers.

a. Thickness: Install valve R-8.
b. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.
c. Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
d. Mechanical Fasteners: Galvanized steel suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in duct.

    1) Tensile Strength: Indefinitely sustain a 50-lb- tensile, dead-load test perpendicular to duct wall.
    2) Fastener Pin Length: As required for thickness of insulation and without projecting more than 1/8 inch into airstream.
    3) Adhesive for Attaching Mechanical Fasteners: Comply with fire-hazard classification of duct liner system.

2.4 SEALANT MATERIALS

A. Joint and Seam Sealants, General: The term "sealant" is not limited to materials of adhesive or mastic nature but includes tapes and combinations of open-weave fabric strips and mastics.

B. Water-Based Joint and Seam Sealant: Flexible, adhesive sealant, resistant to UV light when cured, UL 723 listed, and complying with NFPA requirements for Class 1 ducts.

C. Flanged Joint Mastic: One-part, acid-curing, silicone, elastomeric joint sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.

D. Flange Gaskets: Butyl rubber or EPDM polymer with polyisobutylene plasticizer.

2.5 HANGERS AND SUPPORTS

A. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

    1. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
    2. Exception: Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

B. Hanger Materials: Galvanized sheet steel or threaded steel rod.

    1. Hangers Installed in Corrosive Atmospheres: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
    2. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for steel sheet width and thickness and for steel rod diameters.

3. Galvanized-steel straps attached to aluminum ducts shall have contact surfaces painted with zinc-chromate primer.

C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

D. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel support materials.

E. See Division 23 Section "Hangers and Supports" for additional requirements.

2.6 RECTANGULAR DUCT FABRICATION

A. Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" and complying with requirements for reinforcing types and intervals, tie-rod applications, and joint types and intervals metal thickness shall be per CMC.

1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure class.
2. Deflection: Duct systems shall not exceed deflection limits according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

B. Transverse Joints: Prefabricated slide-on joints and components constructed using manufacturer's guidelines for material thickness, reinforcement size and spacing, and joint reinforcement.

1. Manufacturers:

a. Ductmate Industries, Inc.
b. Nexus Inc.
c. Ward Industries, Inc.

C. Formed-On Flanges: Construct according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," Figure 1-4, using corner, bolt, cleat, and gasket details.

1. Manufacturers:

a. Ductmate Industries, Inc.
b. Lockformer.

2. Duct Size: Maximum 30 inches wide and up to 2-inch wg pressure class.
3. Longitudinal Seams: Pittsburgh lock sealed with noncuring polymer sealant.

D. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches and larger and 0.0359 inch thick or less, with more than 10 sq. ft. of nonbraced panel area unless ducts are lined.

2.7 APPLICATION OF LINER IN RECTANGULAR DUCTS

A. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.

B. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.

C. Butt transverse joints without gaps and coat joint with adhesive.

D. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.

E. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and standard liner product dimensions make longitudinal joints necessary.

F. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.

G. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.

H. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

   1. Fan discharges.
   2. Intervals of lined duct preceding unlined duct.
   3. Upstream edges of transverse joints in ducts where air velocities are greater than 2500 fpm (12.7 m/s) or where indicated.

I. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.

   1. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.

J. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.8 ROUND AND FLAT-OVAL DUCT AND FITTING FABRICATION

A. Diameter as applied to flat-oval ducts in this Article is the diameter of a round duct with a circumference equal to the perimeter of a given size of flat-oval duct.

B. Round, Spiral Lock-Seam Ducts: Fabricate supply ducts of galvanized steel according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

C. Duct Joints:

1. Ducts up to 20 Inches in Diameter: Interior, center-beaded slip coupling, sealed before and after fastening, attached with sheet metal screws.
2. Ducts 21 to 72 Inches in Diameter: Three-piece, gasketed, flanged joint consisting of two internal flanges with sealant and one external closure band with gasket.
3. Ducts Larger Than 72 Inches in Diameter: Companion angle flanged joints per SMACNA "HVAC Duct Construction Standards--Metal and Flexible," Figure 3-2.
4. Round Ducts: Prefabricated connection system consisting of double-lipped, EPDM rubber gasket. Manufacture ducts according to connection system manufacturer's tolerances.

   a. Manufacturers:

      1) Ductmate Industries, Inc.
      2) Lindab Inc.
      3) United McGill.

D. 90-Degree Tees and Laterals and Conical Tees: Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," with metal thicknesses specified for longitudinal-seam straight ducts.

E. Diverging-Flow Fittings: Fabricate with reduced entrance to branch taps and with no excess material projecting from fitting onto branch tap entrance.

F. Fabricate elbows using die-formed, gored, pleated construction. Bend radius of die-formed, gored, and pleated elbows shall be 1-1/2 times duct diameter. Unless elbow construction type is indicated, fabricate elbows as follows:

1. Round Elbows 8 Inches and Less in Diameter: Fabricate die-formed elbows for 45- and 90-degree elbows and pleated elbows for 30, 45, 60, and 90 degrees only. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
2. Round Elbows 9 through 14 Inches in Diameter: Fabricate gored or pleated elbows for 30, 45, 60, and 90 degrees unless space restrictions require mitered elbows. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
3. Round Elbows Larger Than 14 Inches in Diameter and All Flat-Oval Elbows: Fabricate gored elbows unless space restrictions require mitered elbows.
4. Die-Formed Elbows for Sizes through 8 Inches in Diameter and All Pressures 0.040 inch thick with 2-piece welded construction.
5. Round Gored-Elbow Metal Thickness: Same as non-elbow fittings specified above.
6. Flat-Oval Elbow Metal Thickness: Same as longitudinal-seam flat-oval duct specified above.
7. Pleated Elbows for Sizes through 14 Inches in Diameter and Pressures through 10-Inch wg: 0.022 inch.

PART 3 - EXECUTION

3.1 DUCT APPLICATIONS

A. Static-Pressure Classes: Unless otherwise indicated, construct ducts according to the following:

1. Supply Ducts: 2-inch wg.
2. Supply Ducts (before Air Terminal Units): 2-inch wg.
3. Supply Ducts (after Air Terminal Units): 1-inch wg.
4. Supply Ducts (in Mechanical Equipment Rooms): 2-inch wg.
5. Return Ducts (Negative Pressure): 1-inch wg.
6. Exhaust Ducts (Negative Pressure): 1-inch wg.

3.2 DUCT INSTALLATION

A. Construct and install ducts according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.

B. Install round and flat-oval ducts in lengths not less than 12 feet unless interrupted by fittings.

C. Install ducts with fewest possible joints.

D. Install fabricated fittings for changes in directions, size, and shape and for connections.

E. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 12 inches, with a minimum of 3 screws in each coupling.

F. Install ducts, unless otherwise indicated, vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.

J. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.

K. Seal all joints and seams. Apply sealant to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws.

L. Electrical Equipment Spaces: Route ducts to avoid passing through transformer vaults and electrical equipment spaces and enclosures.

M. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls and are exposed to view, conceal spaces between construction openings and ducts or duct insulation with sheet metal flanges of same metal thickness as ducts. Overlap openings on 4 sides by at least 1-1/2 inches.

N. Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire dampers, sleeves, and firestopping sealant. Fire and smoke dampers are specified in Division 23 Section "Duct Accessories." Firestopping materials and installation methods are specified in Division 7 Section "Through-Penetration Firestop Systems."

O. Install ducts with hangers and braces designed to withstand, without damage to equipment, seismic force required by applicable building codes. Refer to SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."

P. Protect duct interiors from the elements and foreign materials until building is enclosed. Follow SMACNA's "Duct Cleanliness for New Construction."

Q. Paint interiors of metal ducts, that do not have duct liner, for 24 inches upstream of registers and grilles. Apply one coat of flat, black, latex finish coat over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 9 painting Sections.

3.3 SEAM AND JOINT SEALING

A. Seal duct seams and joints according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for duct pressure class indicated.

1. For pressure classes lower than 2-inch wg, seal transverse joints.

B. Seal ducts before external insulation is applied.

3.4 HANGING AND SUPPORTING

A. Support horizontal ducts within 24 inches of each elbow and within 48 inches of each branch intersection.

B. Support vertical ducts at maximum intervals of 16 feet and at each floor.

C. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.

D. Install concrete inserts before placing concrete.

E. Install powder-actuated concrete fasteners after concrete is placed and completely cured.

1. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

3.5 CONNECTIONS

A. Make connections to equipment with flexible connectors according to Division 23 Section "Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

END OF SECTION

SECTION 23 33 00

DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Backdraft dampers.
2. Volume dampers.
3. Combination fire and smoke dampers.
4. Turning vanes.
5. Duct-mounting access doors.
6. Flexible connectors.
7. Flexible ducts.
8. Duct accessory hardware.

B. Related Sections include the following:

1. Division 22 Section "Fire Alarm" for duct-mounting fire and smoke detectors.
2. Division 23 Section "HVAC Instrumentation and Controls" for electric and pneumatic damper actuators.

1.3 SUBMITTALS

A. Product Data: For the following:

1. Backdraft dampers.
2. Volume dampers.
3. Combination fire and smoke dampers.
4. Turning vanes.
5. Duct-mounting access doors.
6. Flexible connectors.
7. Flexible ducts.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Special fittings.

2. Manual-volume damper installations.
3. Fire-damper, smoke-damper, and combination fire- and smoke-damper installations, including sleeves and duct-mounting access doors.
4. Wiring Diagrams: Power, signal, and control wiring.

C. Coordination Drawings: Reflected ceiling plans, drawn to scale and coordinating penetrations and ceiling-mounting items. Show ceiling-mounting access panels and access doors required for access to duct accessories.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

1.5 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 SHEET METAL MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated.

B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.

C. Stainless Steel: ASTM A 480/A 480M.

D. Aluminum Sheets: ASTM B 209, alloy 3003, temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

E. Extruded Aluminum: ASTM B 221, alloy 6063, temper T6.

F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 BACKDRAFT DAMPERS

A. Manufacturers:

1. Air Balance, Inc.
2. American Warming and Ventilating.
3. CESCO Products.
4. Duro Dyne Corp.
5. Greenheck.
6. Penn Ventilation Company, Inc.
7. Prefco Products, Inc.
8. Ruskin Company.
9. Vent Products Company, Inc.

B. Description: Multiple-blade, parallel action gravity balanced, with center-pivoted blades of maximum 6-inch width, with sealed edges, assembled in rattle-free manner with 90-degree stop, steel ball bearings, and axles; adjustment device to permit setting for varying differential static pressure.

C. Frame: 0.052-inch- thick, galvanized sheet steel, with welded corners and mounting flange.

D. Blades: 0.025-inch- thick, roll-formed aluminum.

E. Blade Seals: Neoprene.

F. Blade Axles: Nonferrous.

G. Tie Bars and Brackets: Aluminum.

H. Return Spring: Adjustable tension.

2.4 VOLUME DAMPERS

A. Manufacturers:

1. Air Balance, Inc.
2. American Warming and Ventilating.
3. Flexmaster U.S.A., Inc.
4. McGill AirFlow Corporation.
5. METALAIRE, Inc.

6. Nailor Industries Inc.
7. Penn Ventilation Company, Inc.
8. Ruskin Company.
9. Vent Products Company, Inc.

B. General Description: Factory fabricated, with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.

1. Pressure Classes of 3-Inch wg or Higher: End bearings or other seals for ducts with axles full length of damper blades and bearings at both ends of operating shaft.

C. Standard Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, standard leakage rating, and suitable for horizontal or vertical applications.

1. Steel Frames: Hat-shaped, galvanized sheet steel channels, minimum of 0.064 inch thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
2. Roll-Formed Steel Blades: 0.064-inch- thick, galvanized sheet steel.
3. Aluminum Frames: Hat-shaped, 0.10-inch- thick, aluminum sheet channels; frames with flanges where indicated for attaching to walls; and flangeless frames where indicated for installing in ducts.
4. Roll-Formed Aluminum Blades: 0.10-inch- thick aluminum sheet.
5. Extruded-Aluminum Blades: 0.050-inch- thick extruded aluminum.
6. Blade Axles: Nonferrous.
7. Bearings: Oil-impregnated bronze.
8. Tie Bars and Brackets: Aluminum.

D. Jackshaft: 1-inch- diameter, galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.

1. Length and Number of Mountings: Appropriate to connect linkage of each damper in multiple-damper assembly.

E. Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch-thick zinc-plated steel, and a 3/4-inch hexagon locking nut. Include center hole to suit damper operating-rod size. Include elevated platform for insulated duct mounting.

2.5 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers:

1. Greenheck.
2. Ruskin Company.

3. Potterorff

B. General Description: Labeled according to UL 555S. Combination fire and smoke dampers shall be labeled according to UL 555 for 1-1/2-hour rating.

C. Fusible Links: Replaceable, 165 deg F rated.

D. Frame and Blades: 0.064-inch- thick, galvanized sheet steel.

E. Mounting Sleeve: Factory-installed, 0.052-inch- thick, galvanized sheet steel; length to suit wall or floor application.

F. Damper Motors: Modulating and two-position action.

1. Comply with requirements in Division 23 Section "Motors."
2. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
3. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
4. Outdoor Motors and Motors in Outside-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
5. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.
6. Electrical Connection: 115 V, single phase, 60 Hz.

2.6 TURNING VANES

A. Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for vanes and vane runners. Vane runners shall automatically align vanes.

B. Manufactured Turning Vanes: Fabricate 1-1/2-inch- wide, single-vane, curved blades of galvanized sheet steel set 3/4 inch o.c.; support with bars perpendicular to blades set 2 inches o.c.; and set into vane runners suitable for duct mounting.

1. Available Manufacturers:

a. Ductmate Industries, Inc.
b. Duro Dyne Corp.
c. METALAIRE, Inc.
d. Ward Industries, Inc.

2.7 DUCT-MOUNTING ACCESS DOORS

A. General Description: Fabricate doors airtight and suitable for duct pressure class.

B. Door: Double wall, duct mounting, and rectangular; fabricated of galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class. Include vision panel where indicated. Include 1-by-1-inch butt or piano hinge and cam latches.

1. Available Manufacturers:

   a. American Warming and Ventilating.
   b. CESCO Products.
   c. Ductmate Industries, Inc.
   d. Flexmaster U.S.A., Inc.
   e. Greenheck.
   f. McGill AirFlow Corporation.
   g. Nailor Industries Inc.
   h. Ventfabrics, Inc.
   i. Ward Industries, Inc.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Provide number of hinges and locks as follows:

   a. Less Than 12 Inches Square: Secure with two sash locks.
   b. Up to 18 Inches Square: Two hinges and two sash locks.
   c. Up to 24 by 48 Inches: Three hinges and two compression latches with outside and inside handles.
   d. Sizes 24 by 48 Inches and Larger: One additional hinge.

C. Door: Double wall, duct mounting, and round; fabricated of galvanized sheet metal with insulation fill and 1-inch thickness. Include cam latches.

1. Available Manufacturers:

   a. Ductmate Industries, Inc.
   b. Flexmaster U.S.A., Inc.

2. Frame: Galvanized sheet steel, with spin-in notched frame.

D. Seal around frame attachment to duct and door to frame with neoprene or foam rubber.

E. Insulation: 1-inch- thick, fibrous-glass or polystyrene-foam board.

2.8 FLEXIBLE CONNECTORS

A. Manufacturers:

1. Ductmate Industries, Inc.
2. Duro Dyne Corp.
3. Ventfabrics, Inc.
4. Ward Industries, Inc.

B. General Description: Flame-retardant or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.

C. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Select metal compatible with ducts.

D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd..
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

E. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz./sq. yd..
2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
3. Service Temperature: Minus 50 to plus 250 deg F.

F. High-Corrosive-Environment System, Flexible Connectors: Glass fabric with chemical-resistant coating.

1. Minimum Weight: 14 oz./sq. yd..
2. Tensile Strength: 450 lbf/inch in the warp and 340 lbf/inch in the filling.
3. Service Temperature: Minus 67 to plus 500 deg F.

2.9 FLEXIBLE DUCTS

A. Available Manufacturers:

1. Flexmaster U.S.A., Inc.
2. Hart & Cooley, Inc.
3. McGill AirFlow Corporation.

B. Insulated-Duct Connectors: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor barrier film.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 10 to plus 160 deg F.

C. Flexible Duct Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action, in sizes 3 through 18 inches to suit duct size.

2.10 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 APPLICATION AND INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Provide duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

D. Install volume dampers in ducts with liner; avoid damage to and erosion of duct liner.

E. Provide balancing dampers at points on supply, return, and exhaust systems where branches lead from larger ducts as required for air balancing. Install at a minimum of two duct widths from branch takeoff.

F. Provide test holes at fan inlets and outlets and elsewhere as indicated.

G. Install fire and smoke dampers, with fusible links, according to manufacturer's UL-approved written instructions.

H. Install duct silencers rigidly to ducts.

I. Install duct access doors to allow for inspecting, adjusting, and maintaining accessories and terminal units as follows:

1. On both sides of duct coils.
2. Downstream from volume dampers and equipment.
3. Adjacent to fire or smoke dampers, providing access to reset or reinstall fusible links.
4. To interior of ducts for cleaning; before and after each change in direction, at maximum 50-foot spacing.
5. On sides of ducts where adequate clearance is available.

J. Install the following sizes for duct-mounting, rectangular access doors:

1. One-Hand or Inspection Access: 8 by 5 inches.
2. Two-Hand Access: 12 by 6 inches.
3. Head and Hand Access: 18 by 10 inches.
4. Head and Shoulders Access: 21 by 14 inches.
5. Body Access: 25 by 14 inches.
6. Body Plus Ladder Access: 25 by 17 inches.

K. Install the following sizes for duct-mounting, round access doors:

1. One-Hand or Inspection Access: 8 inches in diameter.

2. Two-Hand Access: 10 inches in diameter.
3. Head and Hand Access: 12 inches in diameter.
4. Head and Shoulders Access: 18 inches in diameter.
5. Body Access: 24 inches in diameter.

L. Label access doors according to Division 23 Section "Mechanical Identification."

M. Install flexible connectors immediately adjacent to equipment in ducts associated with fans and motorized equipment supported by vibration isolators.

N. For fans developing static pressures of 5-inch wg and higher, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

O. Connect terminal units to supply ducts directly or with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.

P. Connect diffusers or light troffer boots to low pressure ducts with maximum 7 foot lengths of flexible duct clamped or strapped in place.

Q. Connect flexible ducts to metal ducts with duct clamps.

R. Install duct test holes where indicated and required for testing and balancing purposes.

3.2 ADJUSTING

A. Adjust duct accessories for proper settings.

B. Adjust fire and smoke dampers for proper action.

C. Final positioning of manual-volume dampers is specified in Division 23 Section "Testing, Adjusting, and Balancing."

END OF SECTION

SECTION 23 34 23

POWER VENTILATORS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Centrifugal roof ventilators.
2. Ceiling-mounting ventilators.
3. Utility set.

1.2 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

C. Field quality-control test reports.

D. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

C. UL Standard: Power ventilators shall comply with UL 705.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL ROOF VENTILATORS

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

1. Greenheck.
2. Loren Cook Company.
3. Twin City Fan.

B. Description: Direct- or belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.

C. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone.

1. Hinged Subbase: Galvanized-steel hinged arrangement permitting service and maintenance.

D. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

E. Belt-Driven Drive Assembly: Resiliently mounted to housing, with the following features:

1. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
2. Shaft Bearings: Permanently lubricated, permanently sealed and self-aligning ball bearings.
3. Pulleys: Cast-iron, adjustable-pitch motor pulley.
4. Fan and motor isolated from exhaust air stream.

F. Accessories:

1. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
2. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.
3. UL 762 Listed (Freeze Duct Exhaust).

G. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch- thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base.

1. Configuration: Built-in cant and mounting flange.
2. Overall Height: 8 inches.
3. Sound Curb: Curb with sound-absorbing insulation matrix.
4. Pitch Mounting: Manufacture curb to match roof slope.
5. Metal Liner: Galvanized steel.

2.2 CEILING-MOUNTING VENTILATORS

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

1. Greenheck.

2. Loren Cook Company.
3. Twin City Fan.

B. Description: Centrifugal fans designed for installing in ceiling or wall or for concealed in-line applications.

C. Housing: Steel, lined with acoustical insulation.

D. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.

E. Grille: Painted aluminum, louvered grille with flange on intake and thumbscrew attachment to fan housing.

F. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

G. Accessories:

1. Disconnect switch factory mounted to fan chassis: Non-fused type.
2. Manufacturer's standard roof jack or wall cap, and transition fittings.

2.3 UTILITY SET FANS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Loren Cook Company.
2. Greenheck.
3. Twin City

B. Description: Belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, and accessories.

C. Housing: Fabricated of galvanized steel with side sheets fastened with a deep lock seam or welded to scroll sheets.

1. Housing Discharge Arrangement: Adjustable to eight standard positions.

D. Fan Wheels: Single-width, single inlet; welded to cast-iron or cast-steel hub and spun-steel inlet cone, with hub keyed to shaft.

1. Blade Materials: Aluminum.
2. Blade Type: Backward inclined.
3. Spark-Resistant Construction: AMCA 99, Type B.

E. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.

F. Shaft Bearings: Prelubricated and sealed, self-aligning, pillow-block-type ball bearings with ABMA 9, L_{50} of 200,000 hours.

G. Belt Drives: Factory mounted, with final alignment and belt adjustment made after installation.

1. Service Factor Based on Fan Motor Size: 1.2.
2. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
3. Belts: Oil resistant, non-sparking, and non-static; matched sets for multiple belt drives.
4. Belt Guards: Fabricate of steel for motors mounted on outside of fan cabinet.

H. Accessories:

1. Inlet and Outlet: Flanged.
2. Companion Flanges: Rolled flanges for duct connections of same material as housing.
3. Backdraft Dampers: Gravity actuated with counterweight and interlocking aluminum blades with felt edges in steel frame installed on fan discharge.
4. Access Door: Gasketed door in scroll with latch-type handles.
5. Scroll Dampers: Single-blade damper installed at fan scroll top with adjustable linkage.
6. Inlet Screens: Removable wire mesh.
7. Drain Connections: NPS 3/4 threaded coupling drain connection installed at lowest point of housing.
8. Weather Hoods/OSHA Belt Guard: Weather resistant with stamped vents over motor and drive compartment.
9. Discharge Dampers: Assembly with opposed blades constructed of two plates formed around and to shaft, channel frame, sealed ball bearings, with blades linked outside of air stream to single control lever of same material as housing.

I. Coatings: Powder-baked enamel. Suitable for fume hood exhaust.

J. Capacities and Characteristics: As scheduled on drawings.

1. Vibration Isolators:

   a. Type: Restrained spring isolators.
   b. Static Deflection: 1.0 inch.

2. Spark Arrestance Class: B.

2.4 MOTORS

A. Comply with requirements in Division 23 Section "Motors."

B. Enclosure Type: Totally enclosed, fan cooled.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install power ventilators level and plumb.

B. Secure roof-mounting fans to roof curbs with cadmium-plated hardware. Refer to Division 7 Section "Roof Accessories" for installation of roof curbs.

C. Ceiling Units: Suspend units from structure; use steel wire or metal straps.

D. Install units with clearances for service and maintenance.

E. Label units according to requirements specified in Division 23 Section "Mechanical Identification."

F. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Duct Accessories."

G. Install ducts adjacent to power ventilators to allow service and maintenance.

H. Ground equipment according to Division 26 Section "Grounding and Bonding."

I. Connect wiring according to Division 26 Section "Conductors and Cables."

END OF SECTION

SECTION 23 37 13

DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes ceiling- and wall-mounted diffusers, registers, and grilles.

1.2 SUBMITTALS

A. Product Data: For each product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser, Register, and Grille Schedule: Indicate Drawing designation, room location, quantity, model number, size, and accessories furnished.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
2. Products: Subject to compliance with requirements, provide one of the products specified.
3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 GRILLES AND REGISTERS

A. Fixed Face Grille: RG-1/EG – 1/SWR

1. Products:

a. Price # 530.

2. Manufacturers:

   a. Price Industries.
   b. Krueger.
   c. Titus.
   d. Metal-Aire.

3. Material: Steel. (Aluminum in areas subjected to humid environments).
4. Finish: Bright white baked enamel or powder coat.
5. Face Arrangement: 30□ to 45□ blades at ¾" spacing.
6. Provide opposed blade damper and plaster ring above hard ceiling.
7. Provide lay-in filler panel for T-bar ceiling application.

2.3 CEILING DIFFUSER OUTLETS

A. Square Ceiling Diffusers: CD –1/CD-2.

1. Products: Price # SCD

2. Manufacturers:

   a. Price Industries.
   b. Krueger.
   c. Metal-Aire.
   d. Titus.

3. Material: Steel.
4. Finish: Bright white baked enamel or powder coated.
5. Face Size: See schedule.
6. Face Style: Plaque.
7. Provide opposed blade damper and plaster ring where installed above hard ceilings.
8. Provide lay-in filler panel for T-bar ceiling application.

2.4 CEILING DIFFUSER OUTLETS

A. Double Deflection Ceiling Diffusers: CD –3/SWS.

1. Products: Price # 520D

2. Manufacturers:

   a. Price Industries.
   b. Krueger.
   c. Metal-Aire.
   d. Titus.

3. Material: Steel.
4. Finish: Bright white baked enamel or powder coated.

5. Face Size: See schedule.
6. Face Style: Double Deflection Bar-type (see schedule for blade style).
7. Provide opposed blade damper and plaster ring where installed above hard ceilings.
8. Provide frame for surface mount application.

2.5 ROUND CONE DIFFUSERS

A. Round Cone Diffuser: CD-4.

1. Products: Price # RCDA

2. Manufacturers:

   a. Price Industries.
   b. Krueger.
   c. Metal-Aire.
   d. Titus.

3. Material: Steel.
4. Finish: Bright white baked enamel or powder coated.
5. Face Size: See schedule (see plans for specific sizes in common areas).
6. Face Style: Horizontal and vertical adjustable air pattern.
7. Provide radial damper (style 'VCR9).

2.6 DRUM LOUVER DIFFUSERS

A. Drum Louver Diffuser: DL.

1. Products: Price # HCD1

2. Manufacturers:

   a. Price Industries.
   b. Krueger.
   c. Metal-Aire.
   d. Titus.

3. Material: Steel.
4. Finish: Bright white baked enamel or powder coated.
5. Face Size: See schedule.
6. Face Style: Provide surface mount frame with count sunk screw holes.

2.7 HEAVY DUTY RETURN GRILLES

A. Heavy Duty Return Air Grilles: RG-2.

1. Products: Price Model '96'

2. Manufacturers:

   a. Price Industries.
   b. Krueger.
   c. Metal-Aire.
   d. Titus.

3. Material: Steel.
4. Finish: Bright white baked enamel or powder coated.
5. Face Size: See schedule.
6. Face Style: Bar type (see plan for blade orientation).

2.8 SIDEWALL RETURN AIR REGISTERS

A. Sidewall Return Air Registers: SWR.

1. Products: Price # 530D

2. Manufacturers:

   a. Price Industries.
   b. Krueger.
   c. Metal-Aire.
   d. Titus.

3. Material: Steel.
4. Finish: Bright white baked enamel or powder coated.
5. Face Size: See schedule.
6. Face Style: Bar type (see schedule for blade orientation).

2.9 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practicable. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.2 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

SECTION 23 81 19

ROOFTOP AIR CONDITIONERS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following rooftop air conditioners:

1. Cooling and heating units 6 tons and smaller.
2. Cooling and heating units 7-1/2 to 20 tons.

B. Pitched isolation roof curb.

1.2 SUBMITTALS

A. Product Data: For each model indicated.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection. Prepare the following by or under the supervision of a qualified professional engineer:

1. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.
2. Detail mounting, securing, and flashing of roof curb to roof structure. Indicate coordinating requirements with roof membrane system.
3. Wiring Diagrams: Power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and maintenance data.

E. Warranties: Special warranties specified in this Section.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Code for Mechanical Refrigeration."

C. Energy-Efficiency Ratio: Equal to or greater than prescribed by State of California Title 24, Part 6 Addendum AB-970.

D. Coefficient of Performance: Equal to or greater than prescribed by State of California Title 24, Part 6 Addendum AB-970.

E. Comply with NFPA 54 for gas-fired furnace section.

F. ARI Compliance for Units with Capacities Less Than 135,000 Btuh: Rate rooftop air-conditioner capacity according to ARI 210/240, "Unitary Air-Conditioning and Air-Source Heat Pump Equipment."

1. Sound Power Level Ratings: Comply with ARI 270, "Sound Rating of Outdoor Unitary Equipment."

G. ARI Compliance for Units with Capacities 135,000 Btuh and More: Rate rooftop air-conditioner capacity according to ARI 340/360, "Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment."

1. Sound Power Level Ratings: Comply with ARI 270, "Sound Rating of Outdoor Unitary Equipment."

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace components of rooftop air conditioners that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Compressors: Manufacturer's standard, but not less than five years from date of Substantial Completion.
2. Warranty Period for Heat Exchangers: Manufacturer's standard, but not less than 10 years from date of Substantial Completion.
3. Warranty Period for Control Boards: Manufacturer's standard, but not less than three years from date of Substantial Completion.
4. Warranty Period for Variable-Speed Fan Motors: Manufacturer's standard, but not less than three years from date of Substantial Completion.

1.5 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Belts: One set per A/C unit.
2. Filters: One set per A/C unit.

PART 2 - PRODUCTS

2.1 ROOFTOP AIR CONDITIONERS 6 TONS AND SMALLER

A. Manufacturers:

1. Carrier
2. Trane Co.
3. Approved Equal.

B. Basis of design is Trane units. If contractor submits on listed alternates, he shall assume responsibility for any and all necessary structural, electrical, plumbing, architectural and HVAC modifications, and coordinate such.

C. Description: Factory assembled and tested; designed for exterior installation; consisting of compressor, indoor and outside refrigerant coils, indoor fan and outside coil fan, refrigeration and temperature controls, filters, and dampers.

D. Casing: Galvanized-steel construction with enamel paint finish, removable panels or access doors with neoprene gaskets for inspection and access to internal parts, minimum 1/2-inch- thick thermal insulation, knockouts for electrical and piping connections, exterior condensate drain connection, and lifting lugs.

E. Indoor Fan: Forward curved, centrifugal, belt driven by single-speed motor.

F. Outside Coil Fan: Propeller type, directly driven by motor.

G. Refrigerant Coils: Aluminum-plate fin and seamless copper tube in steel casing with equalizing-type vertical distributor.

H. Compressor: Hermetic scroll compressor with integral vibration isolators, internal overcurrent and over temperature protection, internal pressure relief, and crankcase heater.

I. Refrigeration System:

1. Compressor.
2. Outside coil and fan.
3. Indoor coil and fan.
4. Four-way reversing valve and suction line accumulator.
5. Expansion valve with replaceable thermostatic element.
6. Refrigerant dryer.
7. High-pressure switch.
8. Low-pressure switch.
9. Thermostat for coil freeze-up protection during low-ambient temperature operation or loss of air.
10. Low-ambient switch.
11. Brass service valves installed in discharge and liquid lines.
12. Charge of refrigerant.

J. Filters: 2-inch- thick, fiberglass, pleated, throwaway filters in filter rack. FARR 30/30 Class II. C.S.F.M. No. 3175-0140:006

K. Heat Exchanger: Aluminized-steel construction for natural-gas-fired burners with the following controls:

1. Redundant single or dual gas valve with manual shutoff.
2. Direct-spark pilot ignition.
3. Electronic flame sensor.
4. Induced-draft blower.
5. Flame rollout switch.

L. Economizer: Return- and outside-air dampers with neoprene seals, outside-air filter, and hood.

1. Damper Motor: Fully modulating spring return with adjustable minimum position.
2. Control: Electronic-control system uses mixed-air temperature and selects between outside-air and return-air enthalpy to adjust mixing dampers.
3. Relief Damper: Gravity actuated with bird screen and hood.

M. Power Connection: Provide for single connection of power to unit with control-circuit transformer.

N. Unit Controls: In accordance with 15960.

O. Isolation Curb: Rigid upper and lower steel structure with vibration isolation springs having 1-inch static deflection and vertical and horizontal restraints; with elastomeric waterproof membrane

1. Galvanized steel construction with:

   a. Wood nailer strips.
   b. Base plate.
   c. Acoustical package with two layers of gypsum board attached to upper base member.
   d. Flexible duct supports including flexible connections at duct drops.

2. Pitched construction, top level.

   a. Determine pitch from field conditions.

3. Match unit base.

   a. Gaskets between unit and curb.

4. Seals:

   a. Continuous neoprene wind and water seals.
   b. Seal between base and curb.
   c. Seal between base and bottom of unit.

5. Manufacturers:

   a. Mason Industries, Inc.
   b. CAN FAB

c. Approved Equal

2.2 REFRIGERANTS

A. ASHRAE 34, R-22: Monochlorodifluoromethane.

B. ASHRAE 34, R-410A (Puron): Azeotrope.

2.3 ROOFTOP AIR CONDITIONERS 7-1/2 TO 20 TONS

A. Manufacturers:

1. Carrier
2. Trane Co.
3. Approved Equal

B. Basis of design is Trane units. If contractor submits on listed alternates, he shall assume responsibility for any and all necessary structural, electrical, plumbing, architectural and HVAC modifications, and coordinate such.

C. Description: Factory assembled and tested; designed for exterior installation; consisting of compressor, indoor and outside refrigerant coils, indoor fan and outside coil fan, refrigeration and temperature controls, filters, and dampers.

D. Casing: Galvanized-steel construction with enamel paint finish, removable panels or access doors with neoprene gaskets for inspection and access to internal parts, minimum 1/2-inch-thick thermal insulation, knockouts for electrical and piping connections, exterior condensate drain connection, and lifting lugs.

E. Indoor Fan: Forward curved, centrifugal, belt driven with adjustable motor sheaves, grease-lubricated ball bearings, and motor.

F. Outside Coil Fan: Propeller type, directly driven by permanently lubricated motor.

G. Refrigerant Coils: Aluminum-plate fin and seamless copper tube in steel casing with equalizing-type vertical distributor.

H. Compressor(s): Number as required, hermetic scroll compressors with integral vibration isolators, internal overcurrent and over temperature protection, internal pressure relief, and crankcase heater(s).

I. Refrigeration System:

1. Compressor(s).
2. Outside coil and fan.
3. Indoor coil and fan.
4. Four-way reversing valve and suction line accumulator.
5. Check valves.

6. Expansion valves with replaceable thermostatic elements.
7. Refrigerant dryers.
8. High-pressure switches.
9. Low-pressure switches.
10. Thermostats for coil freeze-up protection during low-ambient temperature operation or loss of air.
11. Independent refrigerant circuits.
12. Brass service valves installed in discharge and liquid lines.
13. Charge of refrigerant.
14. Timed Off Control: Automatic-reset control shuts compressor off after five minutes.

J. Filters: 2-inch- thick, fiberglass, pleated, throwaway filters in filter rack. FARR 30/30 Class II. C.S.F.M. No. 3175-0140:006

K. Heat Exchanger: Aluminized-steel construction for natural-gas-fired burners with the following controls:

1. Redundant dual gas valve with manual shutoff.
2. Direct-spark pilot ignition.
3. Electronic flame sensor.
4. Induced-draft blower.
5. Flame rollout switch.

L. Economizer: Return- and outside-air dampers with neoprene seals, outside-air filter, and hood.

1. Damper Motor: Fully modulating spring return with adjustable minimum position.
2. Control: Electronic-control system uses mixed-air temperature and selects between outside-air and return-air enthalpy to adjust mixing dampers.
3. Relief Damper: Gravity actuated with bird screen and hood.

M. Power Connection: Provide for single connection of power to unit with control-circuit transformer.

N. Unit Controls: In accordance with 15960.

O. Accessories:

1. Power exhaust fan.

P. Isolation Curb: Rigid upper and lower steel structure with vibration isolation springs having 1-inch static deflection and vertical and horizontal restraints; with elastomeric waterproof membrane.

1. Galvanized steel construction with:

a. Wood nailer strips.
b. Base plate.
c. Acoustical package with two layers of gypsum board attached to upper base member.

d. Flexible duct supports including flexible connections at duct drops.

2. Pitched construction, top level.

a. Determine pitch from field conditions.

3. Match unit base.

a. Gaskets between unit and curb.

4. Seals:

a. Continuous neoprene wind and water seals.
b. Seal between base and curb.
c. Seal between base and bottom of unit.

5. Manufacturers:

a. Mason Industries, Inc.
b. CAN FAB
c. Approved Equal

2.4 REFRIGERANTS

A. ASHRAE 34, R-22: Monochlorodifluoromethane.

B. ASHRAE 34, R-410A (Puron): Azeotrope.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb, maintaining manufacturer's recommended clearances.

B. Isolation Curb Support: Install units on isolation curbs and install flexible duct connectors and the following vibration isolation and seismic-control devices. Flexible duct connectors are specified in Division 23 Section "Duct Accessories."

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to machine to allow service and maintenance.

1. Gas Piping: Comply with applicable requirements in "Plumbing Piping and Valves." Connect gas piping to burner, full size of gas train inlet, and connect with ground joint union and shutoff valve with sufficient clearance for burner removal and service.

C. Duct installation requirements are specified in other Division 23 Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:

1. Install ducts to termination in roof curb.
2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
3. Terminate return-air duct through roof structure and insulate space between roof and bottom of unit with 2-inch- thick, acoustic duct liner.

D. Electrical System Connections: Coordinate with Division 26 Sections for power wiring, switches, and motor controls.

3.3 FIELD QUALITY CONTROL

A. Perform the following field quality-control tests and inspections and prepare test reports:

1. After installing rooftop air conditioners and after electrical circuitry has been energized, test units for compliance with requirements.
2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Remove malfunctioning units, replace with new units, and retest as specified above.

3.4 ADJUSTING

A. In accordance with 230593.

END OF SECTION

SECTION 26 01 00

BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SCOPE

A. This section supplements all sections of this division and shall apply to all phases of work hereinafter specified, shown on the drawings, or required to provide a complete installation of electrical systems for the Project. The work required under this division is not limited to the electrical specifications and drawings. Refer to all bid documents including Civil, Architectural, Structural, and Mechanical documents which may designate Work to be accomplished. The intent of the Specifications is to provide a complete and operable electrical system, which shall include all documents that are a part of the entire Project Contract.

1. Work included: Furnish all labor, material, tools, equipment, facilities, transportation, skilled supervision necessary for, and incidental to, performing operations in connection with furnishing, delivery, and installation of the work in this division complete as shown or noted on the Drawings and specified herein.

B. Related Work Specified Elsewhere:

1. Refer to all sections in the general contract conditions, Contract Requirements and Division 1, General Requirements.

C. Work Installed but Furnished by Others:

1. The electrical work includes the installation or connection of certain materials and equipment furnished by others. Verify installation details. Foundations for apparatus and equipment will be furnished by others unless otherwise noted or detailed.

1.2 GENERAL REQUIREMENTS

A. Guarantee See General Conditions:

1. Except as may be specified under other Sections in the specification, guarantee equipment furnished under the specifications for a period of one year, except for equipment required to have a longer guarantee period, from date of final completion. Guarantee all work against defective workmanship, material, and improper installation. Upon notification of failure, correct deficiency immediately and without additional cost to the Owner.
2. Standard warranty of manufacturer shall apply for replacement of parts after expiration of the above period. Manufacturer shall furnish replacement parts to the Owner or his service agency as approved. Furnish to the Owner, through the Architect, printed manufacturer's

warranties complete with material included and expiration dates, upon completion of project. Conform to Division 01.

B. Equipment Safety: All electrical materials and equipment shall be new and shall be listed by Underwriter's Laboratories and bear their label, or listed and certified by a nationally recognized testing authority where UL does not have an approval. Custom made equipment must have complete test data submitted by the manufacturer attesting to its safety.

C. Codes and Regulations:

1. Design, manufacturer, testing and method of installation of all apparatus and materials furnished under the requirements of these specifications shall conform to the latest publications or standard rules of the following:

   a. Institute of Electrical and Electronic Engineers - IEEE
   b. National Electrical Manufacturers' Association - NEMA
   c. Underwriters' Laboratories, Inc. - UL
   d. National Fire Protection Association - NFPA
   e. American Society for Testing and Materials - ASTM
   f. American National Standards Institute - ANSI
   g. California Electrical Code – CEC, Title 24, Part 3
   h. California Code of Regulations, Title 8, Subchapter 5
   i. California Building Code-CBC, Title 24 Parts 1 &2
   j. State & Municipal Codes in Force in the Specific Project Area
   k. Occupational Safety & Health Administration – OSHA
   l. California State Fire Marshal
   m. California Fire Code- CFC, Title 24 Part 9
   n. National Electrical Testing Association - NETA

2. The term "Code", when used within the specifications, shall refer to the Publications, Standards, ordinances and codes, listed above. In the case where the codes have different levels of requirements the most stringent rules shall apply.

D. Requirements of Regulatory Agencies:

1. Codes, Permits, and Fees: Where the Contract Documents exceed minimum requirements, the Contract Documents take precedence. Where code conflicts occur, the most stringent shall apply. The most stringent condition shall be as interpreted by the Engineer.

   a. Comply with all requirements for permits, licenses, fees and Code. Permits, licenses, fees, inspections and arrangements required for the Contractor at his expense shall obtain the Work, unless otherwise specified.
   b. Comply with the requirements of the applicable utility companies serving the Project. Make all arrangements with the utility companies for proper coordination of the Work.

E. Shop Drawings:

1. See Division 01 for additional requirements.

2. Time Schedules for Submission and Ordering: The Contractor shall prepare, review and coordinate his schedule of submissions carefully, determining the necessary lead time for preparing, submitting, checking, ordering and delivery of materials and equipment for timely arrival. The Contractor shall be responsible for conformance with the overall construction schedule.
3. Submittals will be checked for general compliance with specifications only. The Contractor shall be responsible for deviations from the drawings or specifications and for errors or omissions of any sort in submittals.
4. Submit a complete list of materials and equipment proposed for the job, including manufacturers names and catalog numbers.
5. Shop drawings shall be submitted in completed groups of materials (i.e., lighting fixtures or switchgear). The Contractor shall add and sign the following paragraph on equipment and materials submitted for review. "It is hereby certified that the (equipment) (material) shown and marked in this submittal is that proposed to be incorporated into the project; is in compliance with the Contract Drawings and specifications and can be installed in the allocated spaces". Failure to add the above written statement for compliance will result in return of submittals without review.

    a. Bind catalog cuts, plate numbers, descriptive bulletins and drawings, 11" x 17" (275 mm x 435 mm) or smaller, in sets with covers neatly showing titles.
    b. The Contractor shall verify dimensions of equipment and be satisfied as to Code compliance for fit prior to submitting shop drawings for approval.
    c. Where current limiting devices are specified, submit technical data to substantiate adequate protection of equipment cascaded downstream. Submittals shall not be reviewed unless supporting calculations and data are submitted therewith.
    d. Include complete catalog information such as construction, ratings, insulation systems, as applicable.
    e. For any material specified to meet UL or trade standards, furnish the manufacturers or vendor's certification that the material furnished for the work does in fact equal or exceed such specifications.
    f. Reference listings to the specifications' Sections and Article to which each is applicable.
    g. Equipment Floor Plans: After approval of material is secured prepare a floor plan of each electrical and communication equipment space, room or yard, drawn to scale at 1/2 inch equals 1 foot and submit for approval in the same manner as for shop drawings. The layout drawings shall be exact scale.

6. Contractor shall prepare coordinated drawings when required by Division 01 or where noted otherwise.

F. Interpretations: The Contractor through the Architect must make Requests for interpretations of drawings and specifications. Any such requests made by equipment manufacturers or suppliers will be referred to the Contractor.

G. Standard of Quality

1. The contract Drawings and Specifications establish the "MINIMUM STANDARD OF QUALITY" each product and/or system must meet to be considered acceptable. Products of other manufactures will be considered if the product and/or system meet or exceed the "MINIMUM STANDARD OF QUALITY" established by this Contract Document.

H. Submit comprehensive material list, shop drawings and complete technical data for the following equipment and materials:

1. General Requirements:

a. Main service and distribution switchboards.
b. Panelboards.
c. Conduits
d. Conductors, include all selected insulation types.
e. Fuses
f. Disconnect switches and Starters.
g. Pullboxes, manholes and handholes.
h. Standard lighting fixtures, specially fabricated fixtures, ballasts and lamps, with samples and sample of standard finish available (where requested).
i. Control devices, standard and special receptacles, switches, outlets and finish device plates.
j. Cabinets for signal and telephone system, special terminals and cabinets. Include all cabinet dimensions.
k. Fire alarm system.
l. Transformers
m. Data/telephone cables, devices and terminations.

I. Utility Service:

1. Contractor shall verify the locations shown on the drawings and shall include extensions of lines to building service from locations which are acceptable to the Owner.
2. Verify electrical, civil, architectural and structural, dimensional and other requirements with the Owner.
3. Should any major modifications to the work indicated be necessary to comply with the Owner requirements, notify the Architect.

J. Record Drawings: Refer to Division 01, Contract Closeout.

K. Work Responsibilities:

1. The drawings indicate diagrammatically the desired locations or arrangement of conduit runs, outlets, junction boxes and equipment and are to be followed. Execute the work so as to secure the best possible installation in the available space and to overcome local difficulties due to space limitations. The Contractor is responsible for the correct placing of

his work. Where conflicts occur in plans and/or specifications, the most stringent application shall apply and shall be part of the base bid.

2. Locations shown on architectural plan or on wall elevations shall take precedence over electrical plan locations, but where a major conflict is evident, notify the Architect.
3. In the event minor changes in the indicated locations or arrangement are necessary due to developed conditions in the building construction or rearrangement of furnishings or equipment or due to interference with other trades, such changes shall be made without extra cost.
4. Verify dimensions and the correct location of Owner-Furnished equipment before proceeding with the roughing-in of connections.
5. All scaled and figured dimensions are approximate of typical equipment of the class indicated. Before proceeding with work carefully check and verify dimensions and sizes with the drawings to see that the furnished equipment will fit into the spaces provided without violation of applicable Codes.
6. Should any changes to the work indicated on the drawings or described in the specifications be necessary in order to comply with the above requirements, notify the Architect.
7. Contractor shall be responsible for coordination of coordinated drawings when required by the Architect.
8. Replace or repair, without additional compensation any work which does not comply with or which is installed in violation of any of these requirements.

L. Installation General: For special requirements, refer to specific equipment under these requirements.

1. Unless otherwise specified elsewhere in the specifications, do all excavating necessary for the proper installation of the electrical work.
2. Locations of Openings: Locate chases, shafts and openings required for the installation of the electrical work during framing of the structure. Do any additional cutting and patching required. Cutting or drilling in any structural member is prohibited without approval of the Architect. Furnish all access panels to make all boxes, connections and devices accessible as required by CEC.
3. Location of Sleeves: Where conduits pass through concrete walls, suspended slabs or metal deck floors, install sleeves of adequate size to permit installation of conduit. Sleeves shall be installed prior to pouring of concrete and shall have ends flush with the wall or extend 2 inches above floor surfaces. Verify locations.
4. Type of Sleeves: Refer to Section 260500.
5. Wherever conduit extends through roof, install flashings in accordance with drawings and details.
6. Contractor shall be responsible for cutting and patching which may be required for the proper installation of the electrical work.
7. Protect work, materials and equipment cause whatever and provide adequate and proper storage facilities during the progress of the work. Storage outdoors shall be weather protected and shall include space heaters to prevent condensation. Provide for the safety and good condition of all work until final acceptance of the work. Replace all

damaged or defective work, materials and equipment before requesting final acceptance.

8. Conduit and Equipment to be Installed: Clean thoroughly to remove plaster, spattered paint, cement and dirt on both exterior and interior. All underground conduits shall be mandrelled prior to pulling wire.
9. Conduit and Equipment to be Painted: Clean conduit exposed to view in completed structure by removing plaster and dirt. Remove grease, oil and similar material from conduit and equipment by wiping with clean rags and suitable solvents in preparation for paint.
10. Items with Factory Finish: Remove cement, plaster, grease and oil, and leave surfaces, including cracks and corners, clean and polished. Touch up scratched or bare spots to match finish.
11. Site Cleaning: Remove from site all packing cartons, scrap materials and other rubbish on a weekly basis. Vacuum out all cabinets, switchgear and panels and junction boxes prior to pulling any conductors.
12. Electrical equipment and materials exposed to public and in finished areas shall be finish-painted after installation in accordance with the Painting Section. All exposed screw-type fasteners, exterior, or interior in restrooms, shall be vandal-resistant spanner type; include tool.

M. Excavation, Cutting and Patching:

1. Excavating, trenching and backfilling required for the work of this Division in accordance with the applicable requirements of Division 31. Excavating and backfilling connected with electrical work, repaving cuts and providing and maintaining protective measures for the electrical work excavation required by the governing authorities having jurisdiction shall be performed as a part of the work of this Division.
2. Verify openings indicated on the drawings. Provide all cutting, patching and reinforcement of the construction of the building as required to install electrical work.

N. Tests

1. Equipment and systems for which the National Electrical Testing Association (NETA) has an approved or recommended procedure, shall be tested in accordance with that procedure. Test values shall equal values recommended by NETA. Copies of test reports shall be submitted as required under shop drawing submittals.
2. Resistance to ground tests shall be accomplished by a qualified independent testing firm to measure resistance to ground at grounding electrodes. Make tests before slabs or affected areas are poured in order that corrective measures, if required, may be taken. Submit a report showing the results of these measurements. If the resistances exceed values specified elsewhere or NETA test procedure recommendations, perform corrective measures required to reduce resistance to acceptable values.
3. Prior to energizing any motor, measure the service voltage for phase balance and report if unbalance exceeds 1% from mean.

4. Measure the three-phase voltage at no load and at maximum load conditions and submit to the engineer a report showing the results of these measurements.
5. Upon completion of the work and adjustment of all equipment, conduct an operating test. Conduct the test in the presence of an authorized representative of the Architect. Demonstrate system and equipment to operate in accordance with requirements of the Contract Documents and to be free from electrical and mechanical defects. Provide systems free from short circuits and grounds and show an insulation resistance between phase conductors and ground not less than the requirements of the governing electric code. Test circuits for proper neutral connection.
6. Complete tests prior to final inspection of project, including corrective work based on the results of the tests.
7. Perform special tests on systems and equipment as specified herein using personnel qualified to perform such tests.

O. Protection: Protect finish parts of the materials and equipment against damage during the progress of the work and until final completion and acceptance. Cover materials and equipment in storage and during construction in such a manner that no finished surfaces will be damaged or marred. Keep moving parts clean, dry and lubricated.

P. Cleaning Up:

1. Upon completion of the work and at various time during the progress of the work, remove from the building all surplus materials, rubbish and debris resulting from the work of this Division.
2. Thoroughly clean switchgear including busses, apparatus, exposed conduit, metal work including the exterior and interior, and accessories for the work of this Division, of cement, plaster and other deleterious materials; remove grease and oil spots with cleaning solvent; carefully wipe surfaces and scrape cracks and corners clean.
3. Thoroughly polish chromium or plated work. Remove dirt and stains from lighting fixtures.
4. Leave the entire installation in a clean condition.

Q. Completion:

1. The work will not be reviewed for final acceptance until operating and maintenance data, manufacturer's literature, panel directories and nameplates specified herein have been approved and properly posted or installed and final cleaning of equipment and premises has been completed.
2. When the installation is complete and adjustments have been made, operate the system for a period of one week, during which time demonstrate that systems are completed and operating in conformance with the specifications.

R. Operating and Maintenance Data: Submit complete and at one time, prior to acceptance of the installation, 4 copies of manufacturer's instructions for

operation and maintenance of electrical equipment, including replacement parts lists. As specified in Division 01

S. Inspection and Acceptance Procedures: The Architect will submit observation reports periodically during the construction phase detailing Contract deficiencies. The Contractor is responsible for making corrections immediately. Notice of Completion of the project will not be made until all items have been corrected.

T. Final Completion of Electrical Systems:

1. Prior to Final Completion of operating electrical systems, the Contractor shall:

   a. Provide materials of the type and quality specified and as necessary for proper operation, tested and ready for use.
   b. Deliver to the Architect, the Record Documents per 1.3 of this section.
   c. Furnish the required Operating and Maintenance Data/Manuals.
   d. Clean up of the project pertaining to this Division of the work.
   e. After installation has been completed and adjustments made, operate the system for a period of one week, during which time, demonstrate to the Architect that systems are complete and operating in conformance with Contract Documents.
   f. Conduct tests required and as specified in this Division and submit test reports and corrective actions taken.
   g. Submission of warranties and guarantees.

2. Final Completion of Work Shall be Contingent On:

   a. Contractor replacing defective materials and workmanship.
   b. Upon completion of work and adjustments made, Contractor shall conduct an operating test for each system for approval at such time as Architect directs. Conduct test in presence of authorized representative of Architect and demonstrate that systems and equipment do operate in accordance with requirements of the Contract Documents and are free from electrical and mechanical defects.
   c. Contractor shall provide the necessary training programs and instructions to the Owner's representative. Number of hours shall be a minimum of four (4) hours for each system or days as required under separate Sections of these Specifications. Complete operation and maintenance manuals shall be provided at least two (2) weeks prior to training.
   d. Submit copies of manufacturer's instructions and maintenance of electrical equipment including replacement parts lists. Each set shall include one set of shop drawings of equipment installed.

U. Submittals for Change Orders: When changes are made during the construction phase, deletions and additions shall be presented in a manner that will indicate the cost of each item of material and corresponding labor. Markup shall be then added in accordance with the requirements of the General Conditions as modified by the Supplementary Conditions.

V. The Contractor at a time convenient to the Owner shall provide instruction to the Owner's operating personnel in the proper operation and maintenance of all equipment and systems. The instructors shall have received factory training and shall be thoroughly familiar with the equipment installed. The operating personnel shall receive the number of days instruction as indicated in other sections.

1.3 PROJECT RECORD DOCUMENTS

A. Record Drawings: CAD: Use a computer aided drafting (CAD) system in the preparation of record drawings for this Project. Acceptable CAD systems shall be capable of producing files in AutoCAD Version 2000 compatible DWG or DXF format. Owner's consultant will furnish CAD backgrounds for use by the Contractor after construction is 85% complete except where prohibited by Contract.

B. At all times when the work is in progress, maintain at the workplace, fabrication shop or Project Site as applies, a complete separate, clean, undamaged set of the latest stamped, actioned submittals. As work progresses, maintain records of "as installed" conditions on this set in suitable ink or chemical fluid. Update the set daily. After successful completion of Project Site testing specified herein, and after completion of Punch List corrections, copy all records of "as installed" conditions on to originals.

C. Quantity:

1. Review sets: As for Shop and Field Drawings.
2. Record set: Three (3) blueline.
   One (1) mylar.

D. Format: Record Drawings:

1. Pencil, permanent ink or permanent photographic process.

   a. Front face only of Mylar at least 3.0 mils thick.
   b. Appliqué film or lettering prohibited.
   c. Suitable for microfilming. Lettering 1/8" (.8 mm) high minimum.

2. Disk copy of Record Drawings - 1 copy of each drawing file in format noted above, CD-ROM.

E. Content: All drawings required under "Field and Shop Drawings". Show "as installed" condition. Where room designations according to Project permanent signage differ from construction designations in the Contract Documents, show both designations.

F. Warranty Certificates: Comply with Division 01.

PART 2 - PRODUCTS

Not Used

PART3 - EXECUTION

Not Used

END OF SECTION

SECTION 26 05 00

COMMON WORK RESULTS FOR ELECTRICAL

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. Electrical equipment coordination and installation.
2. Sleeves for raceways and cables.
3. Sleeve seals.
4. Grout.
5. Common electrical installation requirements.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For sleeve seals.

1.5 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel.

1. Minimum Metal Thickness:

   a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
   b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Advance Products & Systems, Inc.
   b. Calpico, Inc.
   c. Metraflex Co.
   d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
3. Pressure Plates: Carbon steel. Include two for each sealing element.

4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

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

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria is not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.

G. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable, unless indicated otherwise.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry

1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."

J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes methods and materials for grounding systems and equipment.

1.3 SUBMITTALS

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

B. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in Part 3 "Field Quality Control" Article, including the following:

1. Test wells.
2. Ground rods.
3. Ground rings.
4. Grounding arrangements and connections for separately derived systems.
5. Grounding for sensitive electronic equipment.

C. Qualification Data: For testing agency and testing agency's field supervisor.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For grounding to include the following in emergency, operation, and maintenance manuals:

1. Instructions for periodic testing and inspection of grounding features at grounding connections for separately derived systems based on NETA MTS and CECB.

a. Tests shall be to determine if ground resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if they do not.
b. Include recommended testing intervals.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

   1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association to supervise on-site testing specified in Part 3.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with UL 467 for grounding and bonding materials and equipment.

D. Comply with the California Electrical Code.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

   1. Solid Conductors: ASTM B 3.
   2. Stranded Conductors: ASTM B 8.
   3. Tinned Conductors: ASTM B 33.
   4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
   5. Bonding Conductor: No. 4 AWG, stranded conductor.
   6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
   7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

2.2 CONNECTORS

A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.

   1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 3/4 inch by10 feet (19 mm by 3 m) in diameter.

B. Chemical-Enhanced Grounding Electrodes: Copper tube, straight or L-shaped, charged with nonhazardous electrolytic chemical salts.

1. Termination: Factory-attached No. 4/0 AWG bare conductor at least 48 inches (1200 mm) long.
2. Backfill Material: Electrode manufacturer's recommended material.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.

B. Underground Grounding Conductors: Install bare copper conductor, No. 4/0 AWG minimum.

1. Bury at least 24 inches (600 mm) below grade.
2. Duct-Bank Grounding Conductor: Bury 12 inches (300 mm) above duct bank when indicated as part of duct-bank installation.

C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

D. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus on insulated spacers 1 inch (25 mm), minimum, from wall 6 inches (150 mm) above finished floor, unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, down to specified height above floor, and connect to horizontal bus.

E. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches (100 mm) will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches (50 mm) above to 6 inches (150 mm) below concrete. Seal floor opening with waterproof, nonshrink grout.

C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.

D. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches (150 mm) from the foundation.

3.3 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits sized per C.E.C. Table 250-122.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by CEC:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Armored and metal-clad cable runs.
8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
9. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

D. Water Heater: Install a separate insulated equipment grounding conductor to each electric water heater. Bond conductor to heater units, piping, connected equipment, and components.

E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

G. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in ¾" (19mm) raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch (6-by-50-by-300-mm) grounding bus.
2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

H. Metal Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.4 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Common Ground Bonding with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

C. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade, unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.
2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

D. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Division 26 Section "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches (300 mm) deep, with cover.

1. Test Wells: Install at least one test well for each service, unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

E. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

F. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

G. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

H. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet (18 m) apart.

I. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each steel column and where indicated on the drawings.

1. Install tinned-copper conductor not less than No. 4/0 AWG for ground ring and for taps to building steel.
2. Bury ground ring (where indicated) not less than 24 inches (600 mm) from building foundation.

J. UFER Ground (Concrete-Encased Grounding Electrode): Fabricate according to CEC, using a minimum of 40 feet (12 meters) of bare copper conductor not smaller than No. 4/0 AWG.

1. If concrete foundation is less than 20 feet (6 m) long, coil excess conductor within base of foundation.
2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to grounding electrode external to concrete.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing Agency: Engage a qualified testing and inspecting agency to perform the following field tests and inspections and prepare test reports:

C. Perform the following tests and inspections and prepare test reports:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.

   a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
   b. Perform tests by fall-of-potential method according to IEEE 81.

3. Prepare dimensioned drawings locating each test well, ground rod and ground rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

D. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohms.
5. Substations and Pad-Mounted Equipment: 5 ohms.
6. Manhole Grounds: 10 ohms.

E. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

B. Related Sections include the following:

1. Division 26 Section "Vibration And Seismic Controls For Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Steel slotted support systems.
2. Nonmetallic slotted support systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze hangers. Include Product Data for components.
2. Steel slotted channel systems. Include Product Data for components.
3. Nonmetallic slotted channel systems. Include Product Data for components.
4. Equipment supports.

C. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with CEC.

1.7 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

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

   a. Allied Tube & Conduit.
   b. Cooper B-Line, Inc.; a division of Cooper Industries.
   c. ERICO International Corporation.
   d. GS Metals Corp.
   e. Thomas & Betts Corporation.
   f. Unistrut; Tyco International, Ltd.
   g. Wesanco, Inc.

3. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
4. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
5. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
6. Channel Dimensions: Selected for applicable load criteria.

B. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch- (14-mm-) diameter holes at a maximum of 8 inches (200 mm) o.c., in at least 1 surface.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Allied Tube & Conduit.
   b. Cooper B-Line, Inc.; a division of Cooper Industries.
   c. Fabco Plastics Wholesale Limited.
   d. Seasafe, Inc.

3. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
4. Fitting and Accessory Materials: Same as channels and angles, except metal items may be stainless steel.
5. Rated Strength: Selected to suit applicable load criteria.

C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

D. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of

conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

   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) Hilti Inc.
      2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      3) MKT Fastening, LLC.
      4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated or stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

   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) Cooper B-Line, Inc.; a division of Cooper Industries.
      2) Empire Tool and Manufacturing Co., Inc.
      3) Hilti Inc.
      4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      5) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by CEC. Minimum rod size shall be 1/4 inch (6 mm) in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

   1. Secure raceways and cables to these supports with two-bolt conduit clamps.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in CEC.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

   1. To Wood: Fasten with lag screws or through bolts.

2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts or Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section "Cast-in-Place Concrete or Cast-in-Place Concrete (Limited Applications)" as applicable.

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturers written instructions.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

   1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

B. Touchup: Comply with requirements in Division 09 for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 26 05 33

RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

B. Related Sections include the following:

1. Division 26 Section "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. ENT: Electrical nonmetallic tubing.

C. EPDM: Ethylene-propylene-diene terpolymer rubber.

D. FMC: Flexible metal conduit.

E. IMC: Intermediate metal conduit.

F. LFMC: Liquidtight flexible metal conduit.

G. LFNC: Liquidtight flexible nonmetallic conduit.

H. NBR: Acrylonitrile-butadiene rubber.

I. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.

1. Custom enclosures and cabinets.
2. For handholes and boxes for underground wiring, including the following:

    a. Duct entry provisions, including locations and duct sizes.
    b. Frame and cover design.
    c. Grounding details.
    d. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
    e. Joint details.

C. Samples for Initial Selection: For wireways and surface raceways with factory-applied texture and color finishes.

1. Size: 12" (300mm).

D. Samples for Verification: For each type of exposed finish required for wireways and surface raceway, prepared on Samples of size indicated below.

1. Size: 12" (300mm).

E. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Structural members in the paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.

F. Manufacturer Seismic Qualification Certification: Submit certification that enclosures and cabinets and their mounting provisions, including those for internal components, will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

    a. The term "withstand" means "the cabinet or enclosure will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will retain its enclosure characteristics, including its interior accessibility, after the seismic event.

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

G. Qualification Data: For professional engineer and testing agency.

H. Source quality-control test reports.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with CEC.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

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. AFC Cable Systems, Inc.
2. Alflex Inc.
3. Allied Tube & Conduit; a Tyco International Ltd. Co.
4. Anamet Electrical, Inc.; Anaconda Metal Hose.
5. Electri-Flex Co.
6. Manhattan/CDT/Cole-Flex.
7. Maverick Tube Corporation.
8. O-Z Gedney; a unit of General Signal.
9. Wheatland Tube Company.

C. Rigid Steel Conduit: ANSI C80.1.

D. Aluminum Rigid Conduit: ANSI C80.5.

E. IMC: ANSI C80.6.

F. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

1. Comply with NEMA RN 1.
2. Coating Thickness: 0.040 inch (1 mm), minimum.

G. EMT: ANSI C80.3.

H. FMC: Zinc-coated steel.

I. LFMC: Flexible steel conduit with PVC jacket.

J. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
2. Fittings for EMT: Steel, raintight compression with integral insulated throat.
3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

K. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.2 NONMETALLIC CONDUIT AND TUBING

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. AFC Cable Systems, Inc.
2. Anamet Electrical, Inc.; Anaconda Metal Hose.
3. Arnco Corporation.
4. CANTEX Inc.
5. CertainTeed Corp.; Pipe & Plastics Group.
6. Condux International, Inc.
7. ElecSYS, Inc.
8. Electri-Flex Co.
9. Lamson & Sessions; Carlon Electrical Products.
10. Manhattan/CDT/Cole-Flex.
11. RACO; a Hubbell Company.
12. Thomas & Betts Corporation.

C. ENT: NEMA TC 13.

D. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.

E. LFNC: UL 1660.

F. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.

G. Fittings for LFNC: UL 514B.

2.3 OPTICAL FIBER/COMMUNICATIONS CABLE RACEWAY AND FITTINGS

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. Arnco Corporation.
2. Endot Industries Inc.
3. IPEX Inc.
4. Lamson & Sessions; Carlon Electrical Products.

C. Description: Comply with UL 2024; flexible type, approved for riser installation.

2.4 METAL WIREWAYS

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. Cooper B-Line, Inc.
2. Hoffman.
3. Square D; Schneider Electric.

C. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1 or 3R, unless otherwise indicated on drawings or as required for specific installation.

D. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

E. Wireway Covers: Screw-cover type or Flanged-and-gasketed type for specific installation to maintain NEMA rating.

F. Finish: Manufacturer's standard enamel finish.

2.5 NONMETALLIC WIREWAYS

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. Hoffman.
2. Lamson & Sessions; Carlon Electrical Products.
3. Or approved equal.

C. Description: Fiberglass polyester, extruded and fabricated to size and shape indicated, with no holes or knockouts. Cover is gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections are flanged, with stainless-steel screws and oil-resistant gaskets.

D. Description: PVC plastic, extruded and fabricated to size and shape indicated, with snap-on cover and mechanically coupled connections with plastic fasteners.

E. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

2.6 SURFACE RACEWAYS

A. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish in color selected by Architect in areas not exposed to public view or Prime coating, ready for field painting where exposed to public view.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Thomas & Betts Corporation.
   b. Walker Systems, Inc.; Wiremold Company (The).
   c. Wiremold Company (The); Electrical Sales Division.

B. Surface Nonmetallic Raceways: Not permitted on project.

2.7 BOXES, ENCLOSURES, AND CABINETS

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. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. EGS/Appleton Electric.
3. Erickson Electrical Equipment Company.
4. Hoffman.
5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
6. O-Z/Gedney; a unit of General Signal.
7. RACO; a Hubbell Company.
8. Robroy Industries, Inc.; Enclosure Division.
9. Scott Fetzer Co.; Adalet Division.

10. Spring City Electrical Manufacturing Company.
11. Thomas & Betts Corporation.
12. Walker Systems, Inc.; Wiremold Company (The).
13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.

C. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

D. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

E. Nonmetallic Outlet and Device Boxes: NEMA OS 2.

F. Metal Floor Boxes: Cast or sheet metal, semi-adjustable, rectangular.

G. Nonmetallic Floor Boxes: Not permitted on project.

H. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

I. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.

J. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

K. Cabinets:

1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

2.8 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. Description: Comply with SCTE 77.

1. Color of Frame and Cover: Gray.
2. Configuration: Units shall be designed for flush burial and have integral closed bottom, unless otherwise indicated.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, as indicated for each service.

6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
7. Handholes 12 inches wide by 24 inches long (300 mm wide by 600 mm long) and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel or fiberglass or a combination of the two.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

   a. Armorcast Products Company.
   b. Carson Industries LLC.
   c. CDR Systems Corporation.
   d. NewBasis.
   e. Brooks.

C. Fiberglass Handholes and Boxes with Polymer-Concrete Frame and Cover: Sheet-molded, fiberglass-reinforced, polyester-resin enclosure joined to polymer-concrete top ring or frame.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings.

D. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with covers of reinforced concrete.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings.

2.9 SLEEVES FOR RACEWAYS

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch (1.3- or 3.5-mm) thickness as indicated and of length to suit application.

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

2.10 SLEEVE SEALS

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:

C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Advance Products & Systems, Inc.
2. Calpico, Inc.
3. Metraflex Co.
4. Pipeline Seal and Insulator, Inc.

D. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.

1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
2. Pressure Plates: Carbon steel. Include two for each sealing element.
3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.11 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by a independent testing agency.

2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:

1. Exposed Conduit: Rigid steel conduit or IMC.
2. Concealed Conduit, Aboveground: EMT.
3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
6. Application of Handholes and Boxes for Underground Wiring:

    a. Handholes and Pull Boxes in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Traffic rated steel.
    b. Handholes and Pull Boxes in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Traffic rated steel.
    c. Handholes and Pull Boxes Subject to Light-Duty Pedestrian Traffic Only: Traffic rated steel.

B. Comply with the following indoor applications, unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Physical Damage: IMC. Includes but not limited to, raceways in the following locations:

    a. Shop Areas.
    b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
    c. Mechanical rooms.
    d. Kitchen Areas.

4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
6. Damp or Wet Locations: IMC.
7. Raceways for Optical Fiber or Communications Cable in Spaces Used for Environmental Air: EMT unless otherwise noted on drawings.
8. Raceways for Optical Fiber or Communications Cable Risers in Vertical Shafts: EMT.

9. Raceways for Concealed General Purpose Distribution of Optical Fiber or Communications Cable: EMT.
10. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.

C. Minimum Raceway Size: 1/2-inch (16-mm) trade size for above ground and 1 inch (32mm) trade size for below grade.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.

E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

F. Do not install aluminum conduits in contact with concrete.

3.2 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."

E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

H. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.

3. Change from RNC, Type EPC-40-PVC to coated rigid steel conduit, or IMC before rising above the floor.

I. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

J. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

K. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire.

L. Raceways for Optical Fiber and Communications Cable: Install raceways, metallic and nonmetallic, rigid and flexible, as follows:

1. 3/4-Inch (19-mm) Trade Size and Smaller: Install raceways in maximum lengths of 50 feet (15 m).
2. 1-Inch (25-mm) Trade Size and Larger: Install raceways in maximum lengths of 75 feet (23 m).
3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

M. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where otherwise required by CEC.

N. Expansion-Joint Fittings for RNC: Not permitted on project.

O. Flexible Conduit Connections: Use maximum of 72 inches (1830 mm) of flexible conduit for recessed and semi-recessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

P. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.

Q. Set metal floor boxes level and flush with finished floor surface.

R. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

S. Coordinate with Architectural drawings for tackable wallboards and install box rings so that no space exists between device and wall plate.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A.

1. Install top of duct bank minimum 24 inches (600mm) below finished grade. Adjust depth to avoid interference with gravity flow systems of any kind. Maintain minimum 12 inches (300mm) clearance between duct bank and any gravity flow system.

2. Duct lines shall have a continuous slope downward toward manholes and away from buildings with a pitch of not less than 4 inches (100mm) in 100 feet (300m). Changes in direction of runs exceeding a total of 10 degrees, either vertical or horizontal, shall be accomplished by long sweep bends having a minimum radius of curvature of 25 feet (50m), except that manufactured bends may be used at ends of short runs of 100 feet (300mm) or less, and then only at or close to the end of run.

3. Terminate conduit in end bell at manhole and pullbox entries.

4. Use suitable separators and chairs installed not greater than 4 feet (25m) on centers. Band conduit together with suitable banding devices. Securely anchor conduit to prevent movement during concrete or slurry placement.

5. Provide minimum 3 inches (75mm) concrete 2 sack slurry cover at bottom, top, and sides of duct bank. Refer to Division 31 section for additional information.

6. Provide two No. 4 steel reinforcing bars in top of bank under paved driving areas.

7. Encase non-metallic primary and secondary feeders, telephone, fire alarm communications and data conduit installed underground 2 inches (50-mm) or larger in a concrete or slurry duct bank unless noted otherwise in the Contract Documents. Space the external surfaces of conduit within a bank a minimum of 3 inches (75-mm) apart except that sound, telephone, data and intercommunication circuits contained within non-metallic conduit shall have a minimum separation of 12 inches (300-mm) from any light or power circuits that parallel them within a bank. Use appropriate manufactured plastic spacers to insure the minimum required concrete or slurry coverage. All concrete or slurry duct conduit banks shall contain a warning tape 12 inches (300-mm) above ductbank.

8. Numbers and sizes of ducts shall be as indicated. Depending on the contour of the finished grade, the high-point may be at a terminal, a manhole, a handhole, or between manholes or handholes. Manufactured steel 90-degree duct bends shall be used only for pole or equipment risers, unless specifically indicated as acceptable. The minimum manufactured bend radius shall be 18 inches (450-mm) for ducts of less than 3-inch (75-mm) diameter, and 36 inches (900-mm) for ducts 3 inches (75mm) in diameter 48 inches (1.2-m) for ducts or greater in diameter unless noted otherwise in the Contract Documents. Long sweep bends having a minimum radius of 25 feet (75-m) shall be used for a change of direction of more than 5 degrees, horizontally or vertically. Both curved and straight sections shall be used to form long sweep bends as required, but the maximum curve used shall be 30 degrees and manufactured bends shall be used. Ducts shall be provided with end bells whenever duct lines terminate in manholes, pullboxes or handholes. Duct line markers shall be provided at the ends of long duct line stubouts or for other ducts whose locations are indeterminate because of

duct curvature or terminations at completely below-grade structures. In lieu of markers, a 5-mil brightly colored plastic tape not less than 3 inches (75-mm)in width and suitably inscribed at not more than 10 feet on centers with a continuous metallic backing and a corrosion resistant 1-mil metallic foil core to permit easy location of the duct line, shall be placed approximately 12 inches (300mm) below finished grade levels of such lines.

9. Ducts shall be kept clean of concrete or slurry, dirt or foreign substances during construction. Field cuts requiring tapers shall be made with proper tools and match factory tapers. After a duct line is completed, a standard flexible mandrel shall be used for cleaning followed by a brush with stiff bristles. Mandrels shall be at least 12 inches (300-mm) long and have diameters 1/4 inch (6.2-mm) less than the inside diameter of the duct being cleaned. Pneumatic rodding may be used to draw in lead wires. A coupling recommended by the duct manufacturer shall be used whenever an existing duct is connected to a duct of different material or shape. Ducts shall be stored to avoid warping and deterioration with ends sufficiently plugged to prevent entry of any water or solid substances. Ducts shall be thoroughly cleaned before being laid. Plastic ducts shall be stored on a flat surface and protected from the direct rays of the sun.

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.

D. Install handholes and boxes with bottom depth as required to meet elevation of incoming conduits.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.

F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Rectangular Sleeve Minimum Metal Thickness:

1. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side greater than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches (1270 mm) and 1 or more sides equal to, or greater than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

F. Cut sleeves to length for mounting flush with both surfaces of walls.

G. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.

H. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway unless sleeve seal is to be installed or unless seismic criteria require different clearance.

I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Division 07 Section "Penetration Firestopping."

L. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.

M. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

N. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway and sleeve for installing mechanical sleeve seals.

3.6 SLEEVE-SEAL INSTALLATION

A. Install to seal underground, exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

3.8 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Nameplates.

B. Wire and cable markers.

1.2 SUBMITTALS

A. Submit shop drawings under provisions of Division 01.

B. Include schedule for nameplates and tape labels.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Nameplates: Engraved three-layer laminated plastic, white letters on a white black background.

B. Wire and Cable Markers: Cloth markers, split sleeve or tubing type.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Degrease and clean surfaces to receive nameplates.

B. Install nameplates and tape labels parallel to equipment lines.

C. Secure nameplates to equipment fronts using screws, or rivets. Secure nameplate to inside face of recessed panelboard doors in finished locations.

D. Embossed tape will not be permitted for any application.

3.2 WIRE IDENTIFICATION

A. Provide wire markers on each conductor in panelboard gutters, pull boxes, outlet and junction boxes, and at load connection. Identify with panel and branch circuit or feeder number for power and lighting circuits, and with control wire number as indicated on schematic and interconnection diagrams equipment manufacturer's shop drawings for control wiring.

B. Wire markers for all cables (Electrical, Fire Alarm, Data, Etc.) shall be be identified as follows:

Example: IDF-C1 (Origin)

Room #C1-102 (Termination)

Note: Coordinate with school district for room numbers prior to labeling

3.3 NAMEPLATE ENGRAVING

A. Provide nameplates to identify all circuits in the service distribution and power distribution panelboards; branch circuit panelboards; separately mounted starting switches; disconnecting switches; motor control push-button stations; selector switches; terminal cabinets; telephone cabinets, etc. Clearly identify on the nameplate the equipment such as "Air Handling Unit AH-1" and "Hot Water Cir. Pump P-1" in lieu of abbreviated plan references such as "AH-1" or "P-1".

B. Provide nameplates of minimum letter height as scheduled below.

C. Panelboards and Switchboards: 1/4 inch; identify equipment designation, voltage rating, and source.

D. Individual Circuit Breakers In Panelboards and Switchboards: 1/8 inch; identify circuit and load served, including location.

E. Individual Circuit Breakers, Enclosed Switches and Motor Starters: 1/8 inch; identify voltage rating, ampere rating and load served including location.

F. HVAC and Plumbing Control Equipment: 1/8 inch; identify equipment designation and equipment served including location.

G. Communication Terminal Cabinets: 1/4 inch; identify cabinet designation and type of system.

END OF SECTION

SECTION 26 09 23

LIGHTING CONTROL DEVICES

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. This Section includes the following lighting control devices:

1. Time switches.
2. Indoor occupancy sensors.
3. Lighting contactors.

B. Related Sections include the following:

1. Division 26 Section "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.

C. Related Sections include the following:

1. Division 16 Section "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.

1.3 DEFINITIONS

A. LED: Light-emitting diode.

B. PIR: Passive infrared.

1.4 SUBMITTALS

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

B. Shop Drawings: Show installation details for occupancy and light-level sensors.

1. Interconnection diagrams showing field-installed wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.6 COORDINATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 TIME SWITCHES

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:

C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Intermatic, Inc.
2. Approved equal

D. Electronic Time Switches: Electronic, solid-state programmable units with alphanumeric display; complying with UL 917.

1. Contact Configuration: DPDT.
2. Contact Rating: 30-A inductive or resistive, 240-V ac or 30-A ballast load, 120/240-V ac.
3. Program: 8 on-off set points on a 24-hour schedule and an annual holiday schedule that overrides the weekly operation on holidays.
4. Program: 2 on-off set points on a 24-hour schedule, allowing different set points for each day of the week and an annual holiday schedule that overrides the weekly operation on holidays.
5. Programs: 12 channels; each channel shall be individually programmable with 40 on-off operations per week, plus 4 seasonal schedules that modify the basic program, and an annual holiday schedule that overrides the weekly operation on holidays.

6. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program on selected channels.
7. Astronomic Time: Selected channels.
8. Battery Backup: For schedules and time clock.
9. Poles: 40A, 120V, number as indicated. (4 pole minimum)

2.2 INDOOR OCCUPANCY SENSORS

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:

C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Watt Stopper (The).

D. General Description: As indicated on drawings.

E. Dual-Technology Type: Ceiling mounting; detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on-off functions shall be selectable in the field by operating controls on unit.

1. Sensitivity Adjustment: Separate for each sensing technology.
2. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm), and detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.

2.3 LIGHTING CONTACTORS

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:

C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Products.
2. GE Industrial Systems; Total Lighting Control.
3. Square D; Schneider Electric.

D. Description: Electrically operated and mechanically or electrically held as indicated on drawings, combination type with fusible switch, complying with NEMA ICS 2 and UL 508.

1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
3. Enclosure: Comply with NEMA 250.
4. Provide with control and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.

2.4 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

A. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.2 CONTACTOR INSTALLATION

A. Mount electrically held lighting contactors with elastomeric isolator pads, to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.3 WIRING INSTALLATION

A. Wiring Method: Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 1/2 inch (13 mm).

B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.4 IDENTIFICATION

A. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."

1. Identify controlled circuits in lighting contactors.
2. Identify circuits or luminaries controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches and contactors with a unique designation.

3.5 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
2. Operational Test: Verify operation of each lighting control device, and adjust time delays.

B. Lighting control devices that fail tests and inspections are defective work.

3.6 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.7 DEMONSTRATION

A. Coordinate demonstration of products specified in this Section with demonstration requirements for low-voltage, programmable lighting control system specified in Division 26 Section "Network Lighting Controls."

B. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Wall switches.

B. Receptacles.

C. Device plates and decorative box covers.

1.2 REFERENCES

A. NEMA WD 1 - General-Purpose Wiring Devices.

B. NEMA WD 6 - Wiring Device Configurations.

1.3 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years documented experience.

PART 2 - PRODUCTS

2.1 WALL SWITCHES

A. Single Pole Switch:

1. Hubbell, Model 2121-W.
2. Leviton, Model 5621-2W.
3. Equal by Arrow Hart or Bryant.

B. Double Pole Switch:

1. Hubbell, Model 2122-W.
2. Leviton, Model 5622-2W.
3. Equal by Arrow Hart or Bryant.

C. Three-way Switch:

1. Hubbell, Model 2123-W.
2. Leviton, Model 5623-3W.
3. Equal by Arrow Hart or Bryant.

D. Substitutions: Under provisions of Division 01.

E. Description: NEMA WD 1, heavy-duty specification grade, AC only general-use quiet type rocker switch, UL approved for tungsten lamp loads or inductive loads without derating.

F. Device Body: White plastic with rocker handle.

G. Ratings: 20A., 120-277V A.C. or as required to match with specific branch circuit and load characteristics.

H. Lock type switches shall be Hubbell #1221L only per District standards.

2.2 RECEPTACLES

A. Duplex Convenience Receptacle:

1. Hubbell
2. Leviton
3. Arrow Hart
4. Bryant.

B. GFCI Receptacle:

1. Hubbell
2. Leviton
3. Arrow Hart
4. Bryant.

C. Surge Protected Outlets:

1. Hubbell
2. Leviton
3. Arrow Hart
4. Bryant.

D. Substitutions: Under provisions of Division 01.

E. Description: NEMA WD 1; heavy-duty general-use receptacle. 20 Amp, 125V, 2-pole, 3-wire style line series.

F. Device Body: Plastic.

G. Configuration: NEMA WD 6; type as specified and indicated.

H. Convenience Receptacle: Type 5-20R

I. GFCI Receptacle: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements.

2.3 WALL PLATES

A. Plates shall be brushed stainless steel and supplied for every local switch, receptacle, telephone and data outlet, wall speaker outlet, etc.

B. Weatherproof Cover Plate: Gasketed cast metal with hinged gasketed device cover.

C. Locking Weatherproof Cover Plate: Pass & Seymour #WP26-L or equal at locations Indicated on drawings.

D. Plates shall be engraved and filled, when used for:

1. More than two gangs.
2. Equipment that cannot be seen from the locations.
3. All lock type switches.
4. All receptacles other than 120 volts.
5. All pilot switches.
6. Switches in locations from which the equipment or circuits controlled cannot be readily seen.
7. Manual motor starting switches.
8. Where so indicated on the drawings.
9. As required on all control circuit switches, such as heater controls, etc.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify outlet boxes are installed at proper height.

B. Verify wall openings are neatly cut and will be completely covered by wall plates.

C. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean debris from outlet boxes.

3.3 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install devices plumb and level.

C. Install switches with OFF position down.

D. Install receptacles with grounding pole on top

E. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.

F. Install decorative plates on switches, receptacles, etc., and blank outlets in finished areas.

G. Connect wiring devices by wrapping conductor around screw terminal.

H. Use jumbo size plates for outlets installed in masonry walls.

I. Install galvanized steel plates on outlet boxes and junction boxes in unfinished area, above accessible ceilings, and on surface mounted outlets.

3.4 INTERFACE WITH OTHER PRODUCTS

A. Coordinate locations of outlet boxes provided under Section 260533 to obtain mounting heights specified and indicated on drawings.

B. Install wall switches as indicated on drawings.

C. Install convenience receptacles 18 inches above finished floor.

D. Install convenience receptacle 6 inches above backsplash of counter.

3.5 FIELD QUALITY CONTROL

A. Inspect each wiring device for defects.

B. Operate each wall switch with circuit energized and verify proper operation.

C. Verify that each receptacle device is energized.

D. Test each receptacle device for proper polarity.

E. Test each GFCI receptacle device for proper operation.

3.6 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

END OF SECTION

SECTION 26 28 16

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

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 the following individually mounted, enclosed switches and circuit breakers:

1. Fusible switches.
2. Nonfusible switches.
3. Molded-case circuit breakers.
4. Molded-case switches.
5. Enclosures.

1.3 DEFINITIONS

A. GD: General duty.

B. GFCI: Ground-fault circuit interrupter.

C. HD: Heavy duty.

D. RMS: Root mean square.

E. SPDT: Single pole, double throw.

1.4 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current rating.
4. UL listing for series rating of installed devices.

5. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Manufacturer Seismic Qualification Certification: Submit certification that enclosed switches and circuit breakers, accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems" Include the following:

1. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

   a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
   b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Qualification Data: For testing agency.

E. Field quality-control test reports including the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

F. Manufacturer's field service report.

G. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
2. Time-current curves, including selectable ranges for each type of circuit breaker.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the

InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with CEC.

D. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
2. Altitude: Not exceeding 6600 feet (2010 m).

1.7 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 FUSIBLE AND NONFUSIBLE SWITCHES

A. Manufacturers:

1. Eaton Corporation; Cutler-Hammer Products.
2. General Electric Co.; Electrical Distribution & Control Division.
3. Siemens Energy & Automation, Inc.
4. Square D/Group Schneider.

B. Fusible Switch, 600 A and Smaller: NEMA KS 1, Type HD, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Nonfusible Switch, 600 A and Smaller: NEMA KS 1, Type HD, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

D. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded, and bonded; and labeled for copper and aluminum neutral conductors.
3. Auxiliary Contact Kit: Auxiliary set of contacts arranged to open before switch blades open.

2.3 MOLDED-CASE CIRCUIT BREAKERS AND SWITCHES

A. Manufacturers:

1. Eaton Corporation; Cutler-Hammer Products.
2. General Electric Co.; Electrical Distribution & Control Division.
3. Square D/Group Schneider.

B. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic Trip-Unit Circuit Breakers: RMS sensing; field-replaceable rating plug; with the following field-adjustable settings:

   a. Instantaneous trip.
   b. Long- and short-time pickup levels.
   c. Long- and short-time time adjustments.
   d. Ground-fault pickup level, time delay, and I^2t response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller and let-through ratings less than NEMA FU 1, RK-5.
5. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.
6. GFCI Circuit Breakers: Single- and two-pole configurations with 5-mA trip sensitivity.

C. Molded-Case Circuit-Breaker Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Mechanical style suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
4. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
5. Communication Capability: Circuit-breaker-mounted Integral communication module with functions and features compatible with power monitoring and control system specified in Division 26 Section "Electrical Power Monitoring and Control."
6. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
7. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay.
8. Auxiliary Switch: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
9. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
10. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.

D. Molded-Case Switches: Molded-case circuit breaker with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.

E. Molded-Case Switch Accessories:

1. Lugs: Mechanical style suitable for number, size, trip ratings, and material of conductors.
2. Application Listing: Type HACR for heating, air-conditioning, and refrigerating equipment.
3. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage. Provide "dummy" trip unit where required for proper operation.
4. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay. Provide "dummy" trip unit where required for proper operation.

5. Auxiliary Switch: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
6. Key Interlock Kit: Externally mounted to prohibit operation; key shall be removable only when switch is in off position.

2.4 ENCLOSURES

A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.

1. Outdoor Locations: NEMA 250, Type 3R.
2. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
4. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 CONCRETE BASES

A. Coordinate size and location of concrete bases. Verify structural requirements with structural engineer.

B. Concrete base is specified in Division 26 Section "Hangers and Supports for Electrical Systems," and concrete materials and installation requirements are specified in Division 03.

3.3 INSTALLATION

A. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.

B. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated. Anchor floor-mounting switches to concrete base.

C. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

D. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

3.4 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Identification for Electrical Systems."

B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate as specified in Division 26 Section "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections. Report results in writing.

B. Prepare for acceptance testing as follows:

1. Inspect mechanical and electrical connections.
2. Verify switch and relay type and labeling verification.
3. Verify rating of installed fuses.
4. Inspect proper installation of type, size, quantity, and arrangement of mounting or anchorage devices complying with manufacturer's certification.

C. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

D. Testing Agency: Engage a qualified testing and inspecting agency to perform the following field tests and inspections and prepare test reports:

E. Perform the following field tests and inspections and prepare test reports:

1. Test mounting and anchorage devices according to requirements in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
2. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
4. Infrared Scanning:

   a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Open or remove doors or panels so connections are accessible to portable scanner.
   b. Follow-Up Infrared Scanning: Perform an additional follow-up infrared scan of each unit 11 months after date of Substantial Completion.
   c. Instruments, Equipment and Reports:

      1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

2) Prepare a certified report that identifies enclosed switches and circuit breakers included and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 ADJUSTING

A. Set field-adjustable switches and circuit-breaker trip ranges.

3.7 CLEANING

A. On completion of installation, vacuum dirt and debris from interiors; do not use compressed air to assist in cleaning.

B. Inspect exposed surfaces and repair damaged finishes.

END OF SECTION

SECTION 26 51 00

INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Interior luminaires and accessories.

B. Emergency lighting units.

C. Exit Signs.

D. Ballasts.

E. Fluorescent lamp emergency power supply.

F. Lamps.

G. Luminaire accessories.

1.2 REFERENCES

A. ANSI C78.379 - Electric Lamps - Incandescent and High-Intensity Discharge Reflector Lamps - Classification of Beam Patterns.

B. ANSI C82.1 - Ballasts for Fluorescent Lamps -Specifications.

C. ANSI C82.4 - Ballasts for High-Intensity Discharge and Low Pressure Sodium Lamps (Multiple Supply Type).

D. ANSI/CEC - National Electrical Code.

E. ANSI/NFPA 101 - Life Safety Code.

F. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

G. Title-24 C.C.R.

1.3 SUBMITTALS

A. Submit under provisions of Division 01.

B. Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.

C. Product Data: Provide dimensions, ratings, and performance data.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements.

E. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.4 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 01 and 260100.

B. Accurately record actual locations of each luminaire.

1.5 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division 01.

B. Maintenance Data: Include replacement parts list.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years experience.

1.7 REGULATORY REQUIREMENTS

A. Conform to California building code and NFPA 101 for installation requirements.

PART 2 - PRODUCTS

2.1 LUMINARIES, EMERGENCY LIGHTING UNITS, AND EXIT SIGNS

A. Furnish products as specified on Drawings.

B. Install ballasts, lamps, and specified accessories at factory.

2.2 BALLASTS

A. Fluorescent Ballast:

1. Sylvania Quicktronic ProStart PSX T8
2. Equal by Advance Mark V.
3. Sound Rating: Class A.
4. Description: High power factor type, programmed rapid-start electronic ballast with .74 ballast factor.
5. Provide ballast suitable for lamps specified.
6. Voltage: 120-277
7. Source Quality Control: Certify ballast design and construction by Certified Ballast Manufacturers, Inc. Guarantee ballast replacement for three (3) years.
8. Ballast Protection: Resetting type thermal protector.

B. Fluorescent Dimming Ballast:

1. Sylvania Quicktronic Helios T8.

2. Sound Rating: Class A.

3. Description: High power factor type, programmed rapid start electronic ballast.

4. Provide ballast suitable for lamps specified.

5. Voltage: As noted on drawings.

6. Source Quality Control: California Certified Ballast, U.L. Listed.

7. Protection: ANSIC62.41 CAT. A Transient Protection.

2.3 FLUORESCENT LAMP EMERGENCY POWER SUPPLY

A. Manufacturers:

1. Dual Lite.
2. Siltron.
3. Bodine.

B. Description: Emergency battery power supply suitable for installation in ballast compartment of fluorescent luminaire.

C. Lamp Ratings: One F40CW lamp providing 1400 lumens, minimum.

D. Battery: Sealed type, rated for 10 year life.

E. Include TEST switch and AC ON indicator light, installed to be operable and visible from the outside of an assembled luminaire.

2.4 LAMPS

A. Fluorescent Lamp Manufacturers:

1. Sylvania Octron XPS T8.
2. Equal by Philips or GE

B. Provide lamp type specified for luminaire.

C. Reflector Lamp Beam Patterns: ANSI C78.379.

2.5 ACCESSORIES

A. Provide all required accessories such as sockets, glassware, boxes, spacers, mounting devices, lamps, etc.

B. Provide minimum 0.125 inches (3.175 mm) thick, KSH Pattern 12 100% virgin acrylic lenses where applicable.

C. Provide 50 spare Sylvania Octron XPS T8 lamps.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrate and supporting grids for luminaries.

B. Examine each luminaire to determine suitability for lamps specified.

3.2 INSTALLATION

A. Install in accordance with manufacturers instructions.

B. Locate recessed ceiling luminaries as indicated on reflected ceiling plan.

C. Install surface mounted luminaries and exit signs plumb and adjust to align with building lines and with each other. Secure to prohibit movement.

D. Light Fixture Support: Conform to Section 260529.

E. Install recessed luminaries to permit removal from below.

F. Install wall mounted luminaries, emergency lighting units and exit signs at height as indicated on Drawings.

G. Install accessories furnished with each luminaire.

H. Connect luminaries, emergency lighting units and exit signs to branch circuit outlets provided under Section 260533 as indicated.

I. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

J. Bond products and metal accessories to branch circuit equipment grounding conductor.

K. Install specified lamps in each luminaire, emergency lighting unit and exit sign.

L. Verify all ceiling types and provide lighting fixtures with suitable mounting hardware for mounting in or on subject ceiling.

M. Recessed mounted fixtures shall be approved for the fire rating of the ceiling or shall be enclosed with fire rated material and installed in complete accordance with fire departments requirements.

N. Surface Mounted Fluorescent Fixtures: Where fixtures are indicated for installation on low-density cellulose fiberboard (see room finish schedule on drawings), provide 1-1/2" insulation, unless UL approved for mounting directly to the ceiling material.

O. Standard Plaster Frames: Provide plaster frames for all recessed lighting fixtures installed in plaster or drywall ceilings (see room finish schedule on drawings). Provide plaster frame designed and fabricated of such materials to preclude the possibility of staining the plaster.

P. Properly support and align fixtures and provide all necessary steel shapes for support of the fixtures. Coordinate complete fixture installation with the building construction.

Q. Square and rectangular fixtures shall be mounted with sides parallel to building lines unless otherwise indicated.

R. Where special fixtures to be used in special ceiling are scheduled, verify all ceiling systems and coordinate fixture type and accessories prior to ordering fixtures. Coordinate and cooperate with ceiling supplier in the preparation of ceiling system Shop Drawings.

S. Install fluorescent fixtures as recommended by the manufacturer or as necessary to provide exact horizontal alignment, preventing horizontal or vertical deflection on angular jointing of fixtures suspended in continuous rows.

T. Two-lamp ballasts shall be allowed to feed single lamps in tandem fixtures and shall be properly identified to show which lamps are fed from this ballast by markers on the fixture and the ballast. Provide the quantity and type of ballasts required to achieve switching configuration indicated on the drawings.

3.3 FIELD QUALITY CONTROL

A. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

B. Each fluorescent fixture when initially energized shall be left on continuously for 100 consecutive hours to properly burn in fluorescent lamps.

3.4 ADJUSTING

A. Aim and adjust luminaries as directed.

B. Adjust exit sign directional arrows as indicated.

C. Relamp luminaries that have failed lamps at Substantial Completion.

3.5 CLEANING

A. Clean Work under provisions of Division 01.

B. Clean electrical parts to remove conductive and deleterious materials.

C. Remove dirt and debris from enclosure.

D. Clean photometric control surfaces as recommended by manufacturer.

E. Clean finishes and touch up damage.

3.6 DEMONSTRATION

A. Provide systems demonstration under provisions of Division 01.

B. Provide minimum of two hours demonstration of luminaire operation.

END OF SECTION