

**SECTION 02 41 20**

**SELECTIVE DEMOLITION**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section Includes: Selective demolition of building and site elements.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- C. Related Section
  - 1. Section 31 10 00 - Site Preparation: For surface and subsurface demolition.

**1.02 REFERENCES**

- A. CBC - California Building Code, 2007 Edition
- B. EPA - Environmental Protection Agency

**1.03 DEFINITIONS**

- A. Remove: Remove and legally dispose of items except those indicated to be reinstalled, salvaged, or to remain the District's property.
- B. Remove and Salvage: Items indicated to be removed and salvaged remain the District's property. Remove, clean, and pack or crate items to protect against damage. Identify contents of containers and deliver to the District's designated storage area.
- C. Remove and Reinstall: Remove items indicated; clean, service, and otherwise prepare them for reuse; store and protect against damage. Reinstall items in the same locations or in locations indicated.
- D. Existing to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by the Architect, items may be removed to a suitable, protected storage location during selective demolition and then cleaned and reinstalled in their original locations.
- E. Materials Ownership: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain the District's property, demolished materials shall become the Contractor's property and shall be removed from the site with further disposition at the Contractor's option.

**1.04 SUBMITTALS**

- A. Schedule of selective demolition activities indicating the following:
  - 1. Interruption of utility services and security devices.
  - 2. Coordination for shutoff, capping, and continuation of utility services and security devices.
  - 3. Locations of temporary partitions, air locks, and means of egress.
- B. Inventory of items to be removed and salvaged.
- C. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by selective demolition operations.

- D. Record drawings at Project closeout identifying and accurately locating capped utilities and other subsurface structural, electrical, plumbing, mechanical and security devices.

**1.05 QUALITY ASSURANCE**

- A. Regulatory Requirements
  - 1. Comply with governing EPA notification regulations before starting demolition.
  - 2. Comply with CBC, Chapter 33 for demolition regulations.
  - 3. Comply with hauling and disposal regulations of authorities having jurisdiction.

**1.06 PROJECT CONDITIONS**

- A. Conditions existing at time of inspection for bidding purpose will be maintained by the District as far as practical.
- B. Hazardous Materials: Although there are some hazardous materials, including asbestos, present in the existing buildings, it is not expected that hazardous materials will be encountered during the Work. If any materials not already identified but suspected of being hazardous are encountered, or any materials known to contain asbestos are required to be disturbed to perform the specified work, immediately notify the Architect and the District.
- C. The District will occupy portions of the site adjacent to work areas. Conduct selective demolition so District's operations will not be disrupted.

**PART 2 - PRODUCTS** Not Used

**PART 3 - EXECUTION**

**3.01 EXAMINATION**

- A. Verify that utilities have been disconnected and capped.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- D. When unanticipated plumbing, mechanical, electrical, security, or structural elements that conflict with the intended function or design are encountered, investigate and measure the nature and extent of the conflict. Promptly submit a written report to the Architect.
- E. Survey the condition of the buildings to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of the structures during selective demolition.
- F. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

**3.02 UTILITY SERVICES**

- A. Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
  - 1. Do not interrupt existing utilities serving occupied or operating facilities, except when authorized by the District. Provide temporary services during interruptions to existing utilities, as acceptable to the District and to governing authorities.

- a. Notify the District a minimum of 21 days in advance of any scheduled service interruption.
  - b. Provide not less than 72 hours' notice to the District if shutdown of service is required during changeover.
- B. Utility Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services serving portions of the buildings to be selectively demolished.
1. Arrange to shut off indicated utilities with utility companies.
  2. Where utility services are required to be removed, relocated, or abandoned, provide bypass connections to maintain continuity of service to other parts of the building before proceeding with selective demolition.
  3. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal the remaining portion of pipe or conduit after bypassing.

### **3.03 PREPARATION**

- A. Conduct demolition operations and remove debris to ensure minimum interference with streets, walks, and other adjacent occupied and used facilities.
1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from the District and authorities having jurisdiction.
- B. Conduct demolition operations to prevent injury to people and damage to adjacent buildings and facilities to remain. Ensure safe passage of people around selective demolition area.
1. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.
  2. Protect existing site improvements, appurtenances, and landscaping to remain.
  3. Provide temporary weather protection, during interval between demolition and removal of existing construction, on exterior surfaces to ensure that no water leakage or damage occurs to structure or interior areas.
  4. Protect walls, ceilings, floors, and other existing finish work that are to remain and are exposed during selective demolition operations.
  5. Cover and protect furniture, furnishings, and equipment that have not been removed.
- C. Erect and maintain dustproof partitions, air locks and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.
1. Construct dustproof partitions of not less than nominal 4 inch studs, and 1/2-inch fire retardant plywood on the demolition side.
  2. Seal joints and perimeter.
- D. Provide and maintain interior and exterior bracing or structural support to preserve stability and prevent movement, settlement, or collapse of portions of building to be selectively demolished.
1. Strengthen or add new supports when required during progress of selective demolition.

### **3.04 POLLUTION CONTROLS**

- A. Use water mist, temporary enclosures, and other suitable methods to limit the spread of dust and dirt. Comply with governing environmental protection regulations.
- B. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
1. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level.
- C. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before start of selective demolition.

### **3.05 SELECTIVE DEMOLITION**

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

### **3.06 PATCHING AND REPAIRS**

- A. General: Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.
1. Cut existing construction to provide for installation of other components or performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.
- B. Cutting: Cut existing construction using methods least likely to damage elements retained or adjoining construction.
1. In general, where cutting, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
  2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.
  3. Cut through concrete and masonry using a cutting machine, such as a carborundum saw or a diamond-core drill.
  4. Comply with requirements of applicable Sections where cutting and patching requires excavating and backfilling.

5. Where services are required to be removed, relocated, or abandoned, by-pass utility services, such as pipe or conduit, before cutting. Cut-off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.
- C. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.
1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.
  2. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
  3. Where removing walls or partitions extends one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform color and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
    - a. Where patching occurs in a smooth painted surface, extend final paint coat over entire unbroken surface containing the patch after the area has received primer and second coat.
  4. Patch and repair existing ceilings as necessary to provide an even-plane surface of uniform appearance.

### **3.07 DISPOSAL OF DEMOLISHED MATERIALS**

- A. General: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.
- B. Burning: Do not burn demolished materials.
- C. Disposal
  1. Transport demolished materials off the District's property and legally dispose of them.
  2. When hauling is done over highways or city streets, loads shall be trimmed and the vehicle shelf areas cleaned after each loading.
  3. Contractor shall pay all permit and disposal fees for off-hauled materials.

### **3.08 CLEANING**

- A. Sweep the building broom clean on completion of selective demolition operation.

### **3.09 SELECTIVE DEMOLITION SCHEDULE**

- A. Remove the Following: Demolished site construction materials.

**END OF SECTION**

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**SECTION 03 10 00**

**FORMWORK**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Work Includes: Provision of formwork for cast-in-place concrete and installation of embedded items.
- B. Related Sections:
  - 1. Section 03 20 00 - Concrete Reinforcement.
  - 2. Section 03 30 00 - Cast-In-Place Concrete.

**1.02 REFERENCES**

- A. Requirements of GENERAL CONDITIONS and DIVISION NO. 1 apply to all Work in this Section.
- B. Published specification, standards, tests, or recommended methods of trade, industry, or governmental organizations apply to Work of this Section where cited by abbreviations noted below (latest editions apply).
  - 1. California Code of Regulations, Title 24, Part II, 2007 Edition, also known as California Building Code (CBC).
  - 2. American Society for Testing and Materials (ASTM).
  - 3. American Concrete Institute's "Recommended Practice for Concrete Formwork," (ACI 347).
  - 4. United States Voluntary Product Standard for Construction and Industrial Plywood (PSI-83).
  - 5. American Plywood Association's "Guide to Plywood Grades" (APA).
  - 6. West Coast Lumber Inspection Bureau's "Standard Grading Rules No. 16" (WCLIB).

**1.03 QUALITY ASSURANCE**

- A. Design Criteria: Formwork shall conform to ACI 347 and CBC Section 1906A.
  - 1. Formwork:
    - a. Shall prevent leakage or washing out of cement mortar.
    - b. Shall resist spread, shifting, and settling.
    - c. Shall reproduce accurately required lines, grades, and surfaces within tolerances specified.
  - 2. Safety: The Contractor shall be responsible for adequate strength and safety of all formwork including falsework and shoring.
- B. Allowable Tolerances: Formwork shall produce concrete within tolerance limits recommended in ACI 347, unless otherwise noted.

**1.04 SUBMITTALS**

- A. Samples: Only as requested by the Architect.

**1.05 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use.

**1.06 JOB CONDITIONS**

- A. Sequencing Schedule:

1. Ensure timely delivery of embedded items. Be responsible for cutting and patching necessitated by failure to place embedded items.
2. Plan erection and removal to permit proper sequence of concrete placing without damage to concrete.

## **PART 2 - PRODUCTS**

### **2.01 MATERIALS**

#### **A. Forming Materials:**

1. Panel or board forms at the Contractor's option.
    - a. Panel Forms: Minimum 5/8-inch thick exterior grade plywood with sealed edges, PS 1 grade Plyform Class I and II B-B Exterior or HDO Exterior.
    - b. Board Forms: Shiplap or tongue and groove lined with PS 1 grade Plyform Class I and II Exterior 1/2-inch or HDO Exterior 1/2-inch or 3/16-inch thick fiberboard conforming to FS LLL-B-810a(1), type I.
  2. Forms for Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on Drawings.
    - a. Use Plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood," Class I, Exterior Grade or better, with each piece bearing legible inspection trademark. Panels to receive specified form sealer to ensure uniform finish of exposed surfaces.
    - b. Designated "Architectural Concrete" Surfaces: Use overlaid plywood complying with U.S. Product Standard PS-1 "A-C or B-B High Density Overlaid Concrete Form," Class 1.
  3. Chamfer Strips: Burke Concrete Accessories' PVC type CSF 1/2-inch, all exposed corners.
- B. Wood Framing:** WCLIB standard grade or better Douglas Fir.
- C. Form Ties and Spreaders:** Metal type acting as spreaders, leaving no metal within one inch of concrete face and no fractures, spalls, depressions or other surface disfigurements greater than 3/4-inch in diameter.
- D. Form Sealer:** Same as Grace Construction Material's "Formfilm"; or equal product substituted per Section 01630.
- E. Release Agent:** Must not stain or otherwise adversely affect architectural concrete surfaces. Same as The Nox-Crete Co.'s "Nox-Crete Form Coating"; Industrial Synthetics Corp.'s "Synthex;" or equal product substituted per Section 01630.
- F. Foam Board:** Extruded close cell polystyrene foam, channeled for drainage, with a minimum compressive strength of 25 psi at 0.1-inch deformation when tested in accordance with ASTM D1621-73, and meeting requirements of FS-HH-I-524b, Type II, Class B. Same as The Dow Chemical Co.'s "Styroform PD Brand" or equal product substituted per Section 01630.

### **2.02 SOURCE QUALITY CONTROL**

- A. Plywood shall bear APA grade-trademark.**

## **PART 3 - EXECUTION**



### 3.01 EXAMINATION

- A. Examine areas where formwork will be constructed and verify that:
  - 1. Excavations are sufficient to permit placement, inspection and removal of forms.
  - 2. Excavations for earth forms have been neatly and accurately cut.
  - 3. Conditions are otherwise proper for formwork construction.
- B. Do not start work until unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- A. Obtain necessary information for coordination of formwork with items to be embedded in concrete and other related work.

### 3.03 CONSTRUCTION

- A. General:
  - 1. Design, erect, support, brace and maintain formwork to support vertical and lateral, static, and dynamic loads that might be applied until concrete structure can support such loads. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation and position. Maintain formwork construction tolerances complying with ACI 347.
  - 2. Construct forms to sizes, shapes, lines and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb Work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in Work. Use selected materials to obtain required finishes. Solidly butt joints and provide back-up at joints to prevent leakage of cement paste.
  - 3. Frame openings where indicated on Architectural, Structural, Mechanical, Plumbing and Electrical drawings.
- B. Earth Forms:
  - 1. Construct wood edge strips at top sides of excavations.
  - 2. Provide forms for footings wherever concrete cannot be placed against solid earth excavation.
  - 3. Remove loose dirt and debris prior to concrete pours.
  - 4. Foundation concrete may be placed directly into neat excavations provided the foundation trench walls are stable as determined by the Architect, subject to the approval of DSA. In such case, minimum formwork shown on the drawings is mandatory to ensure clean excavations immediately prior to and during the placing of concrete.
- C. Walls and Other Formed Elements:
  - 1. Erect outside forms for exposed exterior walls first and obtain the Architect's approval before reinforcement is placed. Obtain Architect's approval of the reinforcement before interior form is erected.
  - 2. Carefully align inside and outside forms before tightening ties.
  - 3. Plywood Forms: Insure vertical joints are plumb and horizontal joints are level; arrange joints and ties in geometrical pattern as approved by the Architect.
  - 4. Form inside corners at exposed conditions with mitered boards or plywood so that no concrete is placed against form ends.
  - 5. After erection, seal all cracks, holes, slits, gaps, and apertures in forms so that they will withstand the pressure and will remain completely watertight.
  - 6. Provide a means to seal the bottom of forms at construction joints such as foam tape or other gasket devices.

7. Apply a coating of release agent prior to the erection of formwork. Follow approved manufacturer's recommendations.

D. Slab Forms:

1. Establish levels and set screeds.
2. Depress slabs where required to receive special floor finishes.

E. Cleanouts and Openings: Provide on interior face of wall forms as required for effective removal of loose dirt, debris and waste material, for inspection of reinforcing and for introduction of vibrators where the Architect deems necessary.

F. Construction Joints:

1. Provide where shown on the drawings as directed by the Architect and per CBC Section 1906A.4.
2. Provide key indentations at all joints.
3. Provide pour strips on inside face of forms at horizontal joints, but remove strips and thoroughly clean out reglets before placing subsequent portions of wall.
4. Prevent formations of shoulders and ledges.
5. Provide means for drawing forms into firm contact with concrete before placing additional concrete over previous pours where shrinking and warping has separated concrete from forms.

G. Embedded Items:

1. Properly locate, unless locating is specified elsewhere, and place inserts and embedded items required by other trades prior to casting concrete.

H. Shoring:

1. Adequately brace and maintain shoring to safely support vertical, lateral, and asymmetrical loads until completed structure has attained design strength.
2. Distribute shoring loads over area where shoring is erected and protect against undermining or settlement.
3. Provide means for making vertical adjustments to compensate for settlement either before or during placing of concrete.
4. Construct shores for soffits of beams to permit removal of forms without removing shores.
5. Reshoring will be permitted. Shores and reshores shall be designed by a Civil Engineer registered in the State of California and installed under his/her direction. This Civil Engineer shall be employed by the Contractor.

### 3.04 REMOVAL

- A. Secure the Architect's approval for time and sequence of form removal.
- B. Form Removal: Forms shall be removed without damage to the concrete, and in no case shall they be removed prior to the concrete member attaining the specified strength.

MEMBER	STRENGTH	MINIMUM TIME*
Vertical surfaces of walls, columns, beams,	0.60 f'c	7 days
Beams, slab	0.75 f'c	14 days

\*Estimated curing time required to obtain desired strength. Results of the 7-day test cylinder break shall be presented to the Architect to demonstrate compliance with above specified strength requirements prior

to form removal. If a 7-day test cylinder break demonstrates strength that is less than that specified, the Contractor may elect to take additional cylinders at the time of next pour to demonstrate strength requirements. The Contractor shall bear the cost of taking and testing the additional samples.

- C. Forms, braces, cleats, etc. shall not be disturbed for at least 12 hours after concrete placement.
- D. Forms:
  - 1. Remove forms carefully to avoid damaging corners and edges of exposed concrete.
  - 2. Reuse:
    - a. The Architect will approve reuse of forms provided they are straight, clean, free from nails, dirt, hardened concrete, or other injurious matter and edges and surfaces are in good condition.
    - b. Clean and repair any damage caused by placing, removal, or storage. Reuse of formwork with repairs or patches which would result in adverse effects to architectural concrete finish will not be permitted.
    - c. Store formwork in manner to prevent damage or distortion.
    - d. Reseal as required to achieve concrete of specified quality.

**END OF SECTION**



## SECTION 03 15 13

### HYDROPHILIC RUBBER WATERSTOPS

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. Section Includes: Waterstops embedded in concrete and spanning control, expansion, and/or construction joints as well as pipe and conduit penetrations to create a continuous diaphragm to prevent fluid migration.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

##### 1.02 REFERENCES

- A. ASTM - American Society for Testing and Materials
  - 1. D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
  - 2. D624 - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
  - 3. D2240 - Standard Test Method for Rubber Property - Durometer Hardness.

##### 1.03 DELIVERY, STORAGE, AND HANDLING

- A. Store waterstops under tarps to protect from oil, dirt, sunlight, and premature exposure to water.

#### PART 2 - PRODUCTS

##### 2.01 MANUFACTURERS

- A. Acceptable Manufacturer: Greenstreak Group, Inc., "Hydrotite", or equal.

##### 2.02 MATERIALS

- A. Hydrophilic Rubber Waterstop: Provide profile style number as indicated or as recommended by the manufacturer.
  - 1. The waterstop shall be a combination of chloroprene rubber and chloroprene rubber modified to impart hydrophilic properties.
  - 2. The waterstop shall have a delay coating to inhibit initial expansion due to moisture present in fresh concrete.
  - 3. Performance requirements as follows:
    - a. Chloroprene Rubber
      - 1) Tensile Strength, ASTM D412: 1,300 psi minimum.
      - 2) Ultimate Elongation, ASTM D412: 400 percent minimum.
      - 3) Hardness (Shore A), ASTM D2240: 50 plus or minus 5.
      - 4) Tear Resistance, ASTM D624: 100 lb./in. minimum.
    - b. Modified Chloroprene (Hydrophilic) Rubber
      - 1) Tensile Strength, ASTM D412: 350 psi minimum.
      - 2) Ultimate Elongation, ASTM D412: 600 percent minimum.
      - 3) Hardness (Shore A), ASTM D2240: 52 plus or minus 5.
      - 4) Tear Resistance, ASTM D624: 50 lb./in.
      - 5) Expansion Ratio, Volumetric Change - Distilled Water @ 70 Degrees Fahrenheit: 3 to 1 minimum.

**B. Accessories**

1. Rubber Adhesive for Securing Waterstop to Smooth, Dry Concrete: As manufactured by Greenstreak Group, Inc., "Greenstreak Rubber Adhesive", or equal.
2. Epoxy Gel (2-Component) for Securing Waterstop to Rough, Wet (or Dry) Concrete: As manufactured by Greenstreak Group, Inc., "Greenstreak 7300", or equal.
3. Single Component Hydrophilic Sealant for Securing Waterstop to Rough, Dry Concrete: As manufactured by Greenstreak Group, Inc., "LEAKMASTER", or equal.
4. Glue for All Splices: Provide cyanacrylate adhesive (super glue).

**PART 3 - EXECUTION**

**3.01 INSTALLATION**

- A. Install hydrophilic rubber waterstop in accordance with manufacturer's written recommendations.
1. Cut coil ends square (or at proper angle for mitered corners) with shears or sharp blade to fit splices together without overlaps.
  2. Splices shall be sealed using cyanacrylate adhesive and single component hydrophilic sealant.
  3. Seal watertight any exposed cells of waterstop using single component hydrophilic sealant.
- B. At Pipe Penetration
1. Retrofit applications, where oversize cutouts are made, require the installation of two strips of hydrophilic rubber waterstop. Install one strip around the outside diameter of the cutout, securing with adhesive and concrete fasteners as needed. Apply a second strip directly around the pipe. Slightly stretch the profile and bond the free ends together with cyanacrylate adhesive. Fill the annulus with a non-shrink epoxy grout.
  2. On new construction where concrete will be cast directly around the pipe, apply a single strip of hydrophilic rubber waterstop around the pipe in a similar manner as above.

**END OF SECTION**

## SECTION 03 20 00

### CONCRETE REINFORCEMENT

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. Section Includes: Provision of reinforcement for all concrete unless specifically noted otherwise.
- B. Related Sections:
  - 1. Section 03 10 00 - Formwork.
  - 2. Section 03 30 00 - Cast-In-Place Concrete.

##### 1.02 REFERENCES

- A. Requirements of the GENERAL CONDITIONS and DIVISION NO. 1 apply to all Work in this Section.
- B. Published specifications, standards, tests, or recommended methods of trade, industry, or governmental organizations apply to Work of this Section where cited by abbreviations noted below (latest editions apply).
  - 1. California Code of Regulations, Title 24, Part 2, 2007 Edition, also known as California Building Code (CBC).
  - 2. American Society for Testing and Materials (ASTM).
  - 3. American Concrete Institute's:
    - a. "Manual of Standard Practice for Detailing Reinforced Concrete Structures" (ACI 315).
    - b. "Building Code Requirements for Reinforced Concrete" (ACI 318).
  - 4. Concrete Reinforcing Steel Institute (CRSI):
    - a. "Manual of Standard Practice."
    - b. "Recommended Practice for Placing Reinforcing Bars."
  - 5. American Welding Society's:
    - a. "Mild Steel Covered Arc-Welding Electrodes": (AWS A5.1).
    - b. "Reinforcing Steel Welding Code": (AWS D1.4).

##### 1.03 QUALITY ASSURANCE

- A. Welders' Qualifications: Welders shall be qualified in accordance with AWS D1.4.
- B. Reinforcing steel shall not be permitted to rust where there is danger of staining exposed surfaces of adjacent concrete. The Contractor shall replace rust-stained concrete at his expense.
- C. Allowable Tolerances: Reinforcing steel shall be placed within tolerances permitted by CBC, Section 1907A.5 unless otherwise approved by the Architect.
- D. The Owner's Testing Agency will provide tests in accordance with CBC Section 1916A.
  - 1. Collect mill test reports for reinforcement.
  - 2. Take samples from bundles at fabricators.

- a. When bundles are identified by heat number and accompanied by mill analysis, two specimens shall be taken from each ten (10) tons, or fraction thereof, of each size and grade.
  - b. When reinforcement is not positively identified by heat numbers or when random sampling is intended, two specimens shall be taken from each 2½ tons, or fraction thereof, of each size and grade.
3. Test for yield and tensile strengths including elongation and bend test per ATSM A615.
  4. Provide inspection of welding, including prior fit-up, welding equipment, weld quality and welder certification in accordance with AWS D1.4 and UBC Standard No.19-1. Chemical analysis sufficient to determine carbon equivalent and minimum preheat temperature shall be performed when reinforcement does not conform to low-alloy steel requirements of CBC Section 1903A.4.

#### **1.04 SUBMITTALS**

- A. Shop Drawings: Show bending and placing details, size and location of reinforcing steel. Include diagrammatic wall elevations at 1/4-inch equals one foot scale to clearly show position and erection marks of bars including marginal bars around openings with dowels, splices, etc.
- B. Certified mill test reports (tensile and bending) for each heat or melt of steel prior to delivery of material to the job site. Where reinforcing is to be welded, mill test reports shall verify the weldability of the steel.

#### **1.05 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Deliver reinforcement and accessories to site not more than 48-hours before placement.
- B. Store in manner to prevent excessive rusting and fouling with grease, dirt, or other bond-weakening coatings.
- C. Take precautions to maintain identification after bundles are broken.

### **PART 2 - PRODUCTS**

#### **2.01 MATERIALS**

- A. Bars: New billet steel, ASTM A615 Grade 60.
- B. Welded Bars: New billet steel ASTM A706 Grade 60.
- C. Tie Wires and Spirals: ASTM A82.
- D. Welded Wire Fabric: ASTM A185.
- E. Welding Electrodes: Mild steel covered arc-welding types conforming to AWS A5.1.
- F. Bar Supports: As required for assembling and supporting reinforcement in place.
  1. CRSI Class 3: Where bar supports do not come in contact with exposed concrete surfaces.
  2. CRSI Class 1 plastic-protected; or Class 2 stainless steel wire: Interior and Exterior Soffits and Other Exposed Conditions:
  3. Precast Concrete Wired Block: At slabs-on-grade and as necessary at other locations.
- G. Threaded coupler: Lenton Standard coupler by ERICO or equal product substituted per Section 01630. Couplers may be Type 1 except where otherwise noted.
  1. Type 1 Couplers shall develop 125-percent of specified yield strength reinforcement.



2. Type 2 Couplers shall develop 160-percent of the tensile strength or 200-percent of the yield strength of the reinforcement.
- H. Welded Deformed Bar Anchors: ASTM A-104,  $f_y = 70,000$ , flux filled deformed bar anchors. Same as Nelson D2L or equal product substituted per Section 01630.

## **2.02 FABRICATION**

- A. Shop-fabricate to comply with drawings.
- B. Conform to requirements of ACI 315 where specific details are not shown or where drawings and specifications are not more demanding.

## **PART 3 - EXECUTION**

### **3.01 PLACEMENT**

- A. General:
  1. Place bars as noted.
  2. All reinforcement shall be continuous. See drawings for lap splice schedule. Stagger splices where possible. Contact lap splices shall be securely wired together to maintain alignment.
  3. Ensure placement will permit concrete protection in conformance with CRSI or to extent shown.
  4. Support and fasten bars securely with spacers, chairs or ties to permit their being walked upon without displacement or movement both before and during placement of concrete. Wire-tie bar intersections.
  5. Do not bend bars around openings or sleeves. Wherever conduits, piping, inserts, sleeves, etc. interfere with placing of reinforcement, obtain the Architect's approval of placing before concreting.
  6. Do not field bend bars unless expressly noted in the Contract Documents.
- B. Welding:
  1. Employ shielded metal-arc method and conform to AWS D1.4.
  2. Ensure equipment supplies proper current and voltage and is adjustable to suit arrangement and thickness of items welded.
- C. Prior to placing concrete, verify reinforcement has been bent, positioned, and secured in accordance with drawings; ensure removal of oil, grease, dirt, or other bond-weakening coatings; replace severely rust-pitted reinforcing bars.
- D. Quality Assurance:
  1. The Project Inspector will inspect placement of reinforcement and mechanical splices and notify Structural Engineer of any discrepancies in placement.
  2. The Owner's Testing Agency will inspect shop and field welding of reinforcing bars in accordance with CBC Section 1916A.

**END OF SECTION**



**SECTION 03 30 00**

**CAST-IN-PLACE CONCRETE**

**PART 1 - GENERAL**

**2.01 SUMMARY**

- A. Section Includes: Provision of cast-in-place concrete unless specifically noted otherwise.
- B. Related Sections:
  - 1. Section 03 10 00 - Formwork.
  - 2. Section 03 20 00 - Concrete Reinforcement.
  - 3. Section 05 12 00 - Structural Steel.
  - 4. Section 05 50 00 - Metal Fabrications.

**2.02 REFERENCES**

- A. Requirements of GENERAL CONDITIONS and DIVISION NO. 1 apply to all Work in this Section.
- B. Published specifications, standards, tests, or recommended methods of trade, industry, or governmental organizations apply to Work of this Section where cited by abbreviations noted below (latest editions apply).
  - 1. California Code of Regulations, Title 24, Part 2, 2007 Edition, also known as California Building Code (CBC).
  - 2. American Society for Testing and Materials (ASTM).
  - 3. American Concrete Institute's:
    - a. "Standard Specifications for Tolerances for Concrete Construction and Materials" (ACI 117)
    - b. "Specification for Structural Concrete for Buildings" (ACI 301).
    - c. "Recommended Practice for Measuring, Mixing and Placing Concrete" (ACI 304).
    - d. "Recommended Practice for Hot Weather Concreting" (ACI 305)
    - e. "Recommended Practice for Cold Weather Concreting" (ACI 306)
    - f. "Building Code Requirements for Reinforced Concrete" (ACI 318).
  - 4. State of California, Business and Transportation Agency Division of Highways' "Materials Manual," (CMM).

**2.03 QUALITY ASSURANCE**

- A. The Contractor's Testing Laboratory Qualifications: The Contractor's Testing Laboratory shall be under direction of a Civil Engineer registered in the State of California, shall have operated successfully for four years prior to this work, and shall conform to requirements of ASTM E329.
- B. Requirements of ACI 301 shall govern work, materials and equipment related to this Section; specifications herein set minimum results required, and references to procedures are intended to establish minimal guides.
- C. The Contractor shall be responsible for quality of concrete in place and shall bear burden of proof that concrete meets minimum requirements. Tolerances shall meet the requirements of ACI 117 except as modified in the Construction Documents.
- D. Placing of concrete by means of pumping will be an acceptable method of placement providing that the Contractor can demonstrate that:

1. Specified concrete strengths will be met.
2. Equipment has a record of satisfactory performance under similar conditions and using a similar mix.
3. Trial batches have been made.

**2.04 SUBMITTALS**

- A. The Contractor’s Testing Laboratory’s certificate of compliance per ASTM E329.
- B. The Contractor shall submit:
  1. Certified copies of mix designs for each concrete class specified including compressive strength test reports.
  2. Certification that materials meet the requirements specified.
  3. Samples only as requested by the Architect.
  4. Certification from vendor that samples originate from and are representative of each lot proposed for use.
- C. The Owner’s Testing Agency will submit reports on tests and inspections performed to the Owner, the Architect, the Contractor, and the DSA.
- D. Shop Drawings: Show construction and expansion and contraction joint locations and details.
- E. Schedule of placing for the Architect’s review before starting work.

**2.05 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Ensure storage facilities are weather tight and dry.
- B. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use.
- C. Store bulk cement in bins capable of preventing exposure to moisture.
- D. Use sacked cement in chronological order of delivery. Store each shipment so that it may be readily distinguishable from other shipments.

**PART 2 - PRODUCTS**

**2.01 CONCRETE**

- A. Table 2-1: Concrete Properties

Class	28 -Day Strength	Aggregate Size	Weight	Slump	Water / Cement	% Flyash	Comments
A Foundations	3000	1	145	4	0.50	25	
B Slab on Grade	3000	1	145	4	0.45	15	water-reducing admixture

- B. Strength refers to the compressive strength in psi after 28-days when tested in accordance with ASTM C39. All concrete shall develop compression strength specified in 28-days. To meet above requirements, mix shall

be designed such that average compressive strength will exceed specified 28-day strength by an amount as specified by ACI 318.

- C. Aggregate size refers to the maximum size in inches.
- D. Weight refers to pounds per cubic foot, air dry.
- E. Slump is measured in inches and tested in accordance with ASTM C143.
- F. Water/Cement Ratio is the maximum ratio of water to cementitious material by weight.

## 2.02 MATERIALS

- A. General Requirements:
  - 1. Cement and aggregates shall have proven history of successful use with one another. Sources of cement and aggregate shall remain unchanged through-out work unless the Architect approves request for change made at least 10-days prior to anticipated date of casting.
  - 2. Ready-mixed concrete shall meet requirements of ASTM C94.
  - 3. Deviations in properties of materials tested by the Owner's Testing Agency shall be cause for their rejection pending additional test results and redesign of mix by the Contractor's Testing Laboratory.
  - 4. No frozen aggregates will be permitted.
- B. Cements: ASTM C150, Type II. Use one brand of cement throughout project unless otherwise directed by the Architect.
- C. Fly Ash: ASTM C618, Type F.
- D. Aggregates:
  - 1. Coarse: ASTM C33. Coarse aggregate shall consist of a clean, hard, fine grained, sound crushed rock, or washed gravel or a combination of both. It shall be free from oil, organic matter or other deleterious substances and shall not contain more than two percent by weight of shale or cherty material. "Cleanness value shall not be less than 75 when tested per MM Test Method, 227 and conforming to CBC Section 1903A.3.3.2.
  - 2. Fines: ASTM C33. Sand equivalent shall be not less than 75 when tested as per ASTM D2419.
  - 3. Light Weight Aggregates: ASTM C330; expanded shale type uniformly graded from 3/4-inch to No. 200 Mesh. Cleanliness value and sand equivalent not less than 75.
  - 4. Provide aggregates from a single source for exposed concrete.
- E. Water: Clean and potable, free from impurities detrimental to concrete.
- F. Admixtures:
  - 1. Water-Reducing Admixture: ASTM C494, Type A, non-lignini sulfonate. Same as Grace Construction Materials' "WRDA with Hycol"; Master Builders "Pozzolith 322N"; Sika Corp.'s "Plastocrete 161"; or equal product substituted per Section 01630.
  - 2. Air Entraining Admixture: ASTM C260, certified by manufacturer to be compatible with other products. Same as W.R. Grace's "Daravair," Master Builders' "Micro-Air," Sika Corp.'s "Sika Aer," or equal product substituted per Section 01630.
  - 3. High-Range Water-Reducing Admixture (Super Plasticizer): ASTM C494, Type F or Type G. Same as W.R. Grace's "Daracem 19," Master Builders' "Rheobuild," Sika Corp.'s "Sikament," or equal product substituted per Section 01630.

4. Water Reducing, Accelerator Admixture: ASTM C494, Type E. Same as W.R. Grace's "Polarset," Master Builder's "Pozzutec 20," Sika's "Sikaset NC," or equal product substituted per Section 01630.
  5. Water Reducing, Retarding Admixture: ASTM C494, Type D. Same as W.R. Grace's "Daratard-17," Master Builders' "Pozzoliith R," Sika's "Plastiment," or equal product substituted per Section 01630.
  6. Other Admixtures: Only as approved by the Architect.
- G. Non-Shrink Grout: Premixed high strength grout requiring only addition of water at the site. Same as Master Builder's "Masterflow 928 Grout"; Burke's "Non-Ferrous, Non-Shrink Grout," or equal product substituted per Section 01630.
- H. Curing Materials:
1. Waterproof Paper: ASTM C171, Type 1, regular. Same as Sisalkraft Division of St. Regis Paper Co.'s "Orange Label"; or equal product substituted per Section 01630.
  2. Sheet Plastic: Polyethylene, four mils thick, fungus-resistant.
  3. Curing Compound: ASTM C309. Same as Curecrete Chemical Company's "Ashford Formula," Master Builders' "Masterkure N-Seal-W," or equal product substituted per Section 01630.
- I. Epoxy Adhesive: Two component material suitable for anchoring rebar into dry or damp concrete. Same as Covert's "CIA-Gel 7000," Hilti's RE-500-SD," Simpson Strong-Tie's "SET-XP" or equal product substituted per Section 01630.
- J. Sleeves through concrete: ASTM A53 galvanized per ASTM A153.

### 2.03 MIXES

- A. General Requirements:
1. The Contractor shall perform tests or assemble the necessary data indicating conformance with specifications.
  2. For each mix submit data showing that proposed mix will attain the required strength in accordance with requirements of CBC Section 1905A.3, "Proportioning on the basis of field experience or trial mixtures,"
  3. If sufficient test results for "Proportioning on the basis of field experience or trial mixtures, or both," CBC Section 1905A.3 are not available, the contractor shall proportion concrete mixes in accordance with requirements of CBC Section 1905A.4, "Proportioning without field experience or trial mixtures"
  4. The Contractor shall instruct Laboratory to base mix design on use of materials tested and approved by the Owner's Testing Agency.
  5. Mix design shall include compression strength test reports per CBC Section 1905A.3 or CBC Section 1905A.4 or CBC Section 1905A.6 as appropriate.
  6. Mix shall be designed, tested, and adjusted if necessary in ample time before first concrete is scheduled to be placed. Laboratory data and strength test results for revised mix design shall be submitted to Architect prior to using in project.
  7. Ensure mix designs will produce concrete to strengths specified and of uniform density without segregation.
  8. If mix yield exceeds 1-cubic yard, modify mix design to no more than one cubic yard without changing cement content.
  9. The Contractor's mix designs shall be subject to review by the Architect and by the Owner's Testing Agency.
  10. Introduction of calcium chloride will not be permitted.
  11. Unspecified admixtures will not be permitted unless the Architect reviews, the Contractor modifies mix designs as necessary, and modifications are accepted by the Owner's Testing Agency.
- B. Slab-on-Grade Mix requirements: Use of Water-Reducing admixture is required. High Range Water-Reducing admixture (super plasticizer) shall be used when required to maintain workability and pumpability.

- C. Patching Mortar: Mix in proportions by volume of one part cement to two parts fine sand.
- D. Non-Shrink Grout: Follow approved manufacturer's printed instructions and recommendations.

#### **2.04 MIXING**

- A. Batching Plant Conditions:
  - 1. Batch plant shall be certified to comply with the requirements of the National Concrete Ready Mix Association.
  - 2. Ensure equipment and plant will afford accurate weighing, minimize segregation and will efficiently handle all materials to satisfaction of the Architect and the Owner's Testing Agency.
  - 3. Replace at no additional expense equipment the Architect and the Owner's Testing Agency deem inadequate or unsuitable.
  - 4. Use approved moisture meter capable of determining moisture content of sand.
- B. General Requirements:
  - 1. Thoroughly clean concrete equipment before use for architectural concrete mixes to avoid contamination.
  - 2. Mix cement, fine and coarse aggregates, admixtures and water to exact proportions of mix designs. Method of mixing shall comply with CBC Section 1905A.8.
  - 3. Measure fine and coarse aggregates separately according to approved method that provides accurate control and easy checking.
  - 4. Adjust grading to improve workability; do not add water unless otherwise directed.
  - 5. Maintain proportions, values, or factors of approved mixes throughout work.
  - 6. Mix concrete in transit mixers five minutes immediately prior to discharge in addition to mixing as called for by ACI 304 and ASTM C94.
- C. Admixtures: Use automatic metering dispenser to introduce admixture into mix. Dispenser shall be recommended and calibrated by admixture manufacturer.

#### **2.05 SOURCE QUALITY CONTROL**

- A. The Owner's Testing Agency will:
  - 1. Review mix designs, certificates of compliance, and samples of materials the Contractor proposes to use.
  - 2. Test and inspect materials, as necessary, in accordance with ACI 318 and CBC Sections 1903A, 1905A and 1916A for compliance with requirements.
  - 3. Take samples as required from the Contractor's designated sources.
  - 4. Take one grab sample for each 100 tons of Portland cement except that, when used in bulk loading ready-mix plants where separate bins for pretested cement are not available, take grab samples for each shipment of cement placed in bin with not less than one sample being taken for each day's pour and subsequently test such samples if required by the Architect who may be so advised by DSA.
  - 5. Test both coarse and fine aggregate by use of solution of sodium or magnesium sulfate, or both whenever in the judgment of the Architect such tests are necessary to determine quality of material. Perform such tests in accordance with ASTM C88. Loss shall not exceed 6-percent of either fine or coarse aggregate. Aggregate failing to comply with this requirement may be used in the Work provided it contains less than 2-percent of shale and other deleterious particles and shows a loss in soundness test of not more than 10-percent when tested in the sodium sulphate solution. Test aggregates as required by CBC Section 1903A.3.
  - 6. Test for sand equivalent of fine aggregate in accordance with California Test 217.
  - 7. Test for cleanness value of coarse aggregate in accordance with California Test 227.
  - 8. Inspect plant prior to any work to verify following:

- a. Plant is equipped with approved metering devices for determining moisture content of fine aggregate.
  - b. Other plant quality controls are adequate.
9. Continuously inspect quality and quantity of materials used in transit mixed concrete, in batched aggregates and ready-mixed concrete at mixing plant or other location per CBC Section 1929A.4 where other materials are measured.
- B. Waiver of Batch Plant Inspection:
1. Continuous batch plant inspection may be waived in accordance with CBC Section 1929A.5 if the plant complies with ASTM C94 and has been certified by an agency acceptable to DSA to comply with the requirements of the National Ready Mix Concrete Association.
  2. When batch plant inspection is waived, the following requirements shall apply:
    - a. Testing Agency shall check the first batching at the start of work and furnish mix proportions to the licensed Weighmaster.
    - b. Licensed Weighmaster shall identify material quantities and certify each load by a ticket.
    - c. Project Inspector shall collect truck mix tickets with load identification and maintain a daily record of placement. Trucks without a load ticket identifying the mix shall be rejected. Copies of daily placement record shall be submitted to DSA.
    - d. At the end of the project, the Weighmaster shall submit an affidavit to DSA certifying that all concrete supplied conforms to proportions established by mix designs.

### **PART 3 - EXECUTION**

#### **3.01 EXAMINATION**

- A. Examine units of work to be cast and verify that:
1. Construction of formwork is complete.
  2. Required reinforcement, inserts, and embedded items are in place.
  3. Form ties at construction joints are tight.
  4. Concrete-receiving places are free of debris.
  5. Dampen subgrade or sand course for slabs-on-grade. Do not saturate.
  6. Depths of depressed slab conditions are correct for delayed finish noted and for its proper bonding to concrete.
  7. Conveying equipment is clean and properly operating.
  8. The Architect has reviewed formwork and reinforcing steel and that preparations have been checked with the Project Inspector.
- B. Do not begin casting before unsatisfactory conditions have been corrected.

#### **3.02 PREPARATION**

- A. Ensure availability of sufficient labor, equipment and materials to place concrete correctly in accordance with scheduled casting.
- B. Protect finished surfaces adjacent to concrete-receiving places.
- C. Clean transportation and handling equipment at frequent intervals and flush thoroughly with water before each day's run. Do not discharge wash water into concrete form.



### 3.03 PLACING

- A. The Inspector of Record, Architect, Structural Engineer, Testing Laboratory and DSA shall be notified at least 48 hours before placing concrete.
- B. Place concrete in accordance with CBC Section 1905A.
- C. Place concrete in cycles as a continuous operation to permit proper and thorough integration and to complete scheduled placement. Place no concrete where sun, wind, heat, or facilities prevent proper finishing and curing.
- D. Convey concrete as rapidly and directly as practicable to preserve quality and to prevent separation from rehandling and flowing; do not deposit concrete initially set. Complete placement of concrete within ninety (90) minutes after adding water unless otherwise noted. Retempering of concrete which has partially set will not be permitted.
- E. Take precautions to avoid damage to under-slab moisture barrier and displacement of reinforcement and formwork.
- F. Deposit concrete vertically in its final position. Avoid free falls in excess of six feet where reinforcement will cause segregation and in typical conditions unless the Architect approves otherwise.
- G. Keep forms and reinforcement clean above pour line by removing clinging concrete with wire brush before casting next lift. Also remove leakage through forms.
- H. Interruption in casting longer than 60-minutes shall be cause for discontinuing casting for remainder of day. In this event, cut back concrete and provide construction joints as the Architect directs; clean forms and reinforcement as necessary to receive concrete at a later time.
- I. Hot Weather Concreting: Conform to ACI 305 and following requirements when mean daily temperature rises above 75 degrees Fahrenheit.
  - 1. An upper temperature limit of concrete mixes shall be established by the Contractor for each class of concrete. Concrete temperature during placing shall not be so high as to cause difficulty from loss of slump, flash set, or cold joints, and shall not exceed 90°F. Other project climatic conditions detrimental to concrete quality such as relative humidity, wind velocity, and solar radiation shall also be considered.
  - 2. Trial batches of concrete for each mix design shall be made at the limiting mix temperature selected. In lieu of trial batches, compression strength test reports (20 minimum) at the limiting temperature for each proposed mix shall be submitted to the Owner's testing laboratory for review.
  - 3. Practices to maintain concrete below maximum limiting temperature shall be in accordance with ACI 305. Concrete ingredients may be cooled before mixing, or flake ice or well-crushed ice of a size that will melt completely during mixing may be substituted for part of the mixing water.
  - 4. Practices to avoid the potential problems of hot weather concreting shall be employed by the Contractor in accordance with ACI 305.
  - 5. When the temperature of the reinforcing steel or steel deck forms is greater than 120°F, reinforcing and forms shall be sprayed with water just prior to placing the concrete.
- J. Cold Weather Concreting:
  - 1. No placement of concrete will be allowed at temperatures below 20 degrees Fahrenheit or if mean daily temperature for curing period is anticipated to be below 20 degrees Fahrenheit.
  - 2. No concrete placement will be allowed on frozen subgrade.
  - 3. Conform to ACI 306 and following requirements when mean daily temperature falls below 40 degrees Fahrenheit.

- a. Reinforcement, forms or ground to receive concrete shall be completely free from frost.
- b. Concrete at time of placement for footings shall have temperature no lower than 50 degrees Fahrenheit, for all other concrete this minimum temperature at time of placement shall be 60 degrees Fahrenheit. Maximum temperature shall be 90 degrees Fahrenheit.
- c. Concrete shall be maintained at temperature no lower than 50 degrees Fahrenheit for minimum 7-day period after placement by means of blanket insulation, heaters, or other methods as approved by the Architect.
- d. Use of calcium chloride or admixtures containing calcium chloride as accelerators will not be permitted.
- e. The Contractor shall keep a record of concrete surface temperature for first 7-days after each pour. This record shall be open to inspection by the Architect.

K. Consolidating:

1. Use vibrators for thorough consolidation of concrete.
2. Provide vibrators for each location during simultaneous placing to ensure timely consolidation around reinforcement, embedded items and into corners of forms; ensure availability of spare vibrators in case of failures. Vibrate through full depth of freshly placed concrete.
3. Do not place vibrators against reinforcement, attach to forms, or use to spread concrete.
4. Exposed Concrete: Vibrate with rubber type heads and, in addition, spade along forms with flat strap or plate.

L. Construction Joints:

1. Verify location and conformance with typical details; provide only where designated or approved by the Architect. Comply with CBC Section 1906A.4. Construction joints require keys and additional reinforcement unless otherwise noted; consult architect for details.
2. All horizontal and vertical construction joints to be thoroughly sandblasted to clean and roughen entire surface to minimum 1/4-inch relief exposing clean coarse aggregate solidly embedded in mortar matrix.
3. Just prior to depositing concrete, the surface of the construction joint shall be thoroughly wetted.

M. Contraction (Control) Joints in Slabs-on-Grade:

1. Construct contraction joints in slabs-on-ground to form panels of patterns indicated on Shop Drawings. Use saw cuts 1/8" x 1/4 slab depth, unless otherwise indicated.
2. Time saw cutting to allow sufficient curing of concrete to prevent raveled or broken edges.
3. Contraction joints in unexposed floor slabs may be formed by saw cuts as soon as possible after slab finishing as may be safely done without dislodging aggregate.
4. If joint pattern not shown, provide joints not exceeding 15' in either direction and located to conform to bay spacing wherever possible (at column centerlines, half bays, third-bays).

N. Walls and Other Formed Elements:

1. Space points of deposit to eliminate need for lateral flow. Placing procedures of concrete in forms permitting escape of mortar, or flow of concrete itself, will not be permitted.
2. Level top surface upon stopping work.
3. Take special care to fill each part of the forms by depositing concrete directly as near final position as possible, and to force concrete under and around reinforcement, embedded items, without displacement.
4. After concrete has taken its initial set, care shall be exercised to avoid jarring forms or placing any strain on ends of projecting reinforcement.
5. Where backfill is placed against a wall, it shall be adequately shored until it has attained design strength.

O. Penetrations Through Concrete:

1. Penetrations through structural concrete for conduit, piping or other items must be approved by the Architect.
2. Where such penetrations are approved, provide steel galvanized pipe sleeves as follows:
  - a. Reinforcement must not be displaced. Provide minimum 3/4" clearance between reinforcement and sleeve.
  - b. Sleeves shall be Schedule 40, 60, 80, or 160 as follows based on pipe diameter "D" per Table 3-1.
  - c. Spacing and edge distances shall conform to Table 3-1.

P. Table 3-1: Pipe Sleeves at Penetrations

Pipe Diameter "D"	A53 Pipe Thickness	Minimum Center-to-Center Spacing	Minimum Edge Distance
≤ 2"	Schedule 40	6"	4"
>2" ≤ 4"	Schedule 60	3D	6"
>4" ≤ 8"	Schedule 80	3½ D	1½ D
>8" ≤ 12"	Schedule 120	4D	2D
> 12"	Not Permitted		

### 3.04 CURING

A. General Requirements:

1. Take curing measures immediately after casting and for measures other than application of curing compound, extend for seven days. The Architect may recommend longer periods based upon prevailing temperature, wind and relative humidity. Comply with CBC Section 1905A.11.
2. Avoid alternate wetting and drying and fluctuations of concrete temperature.
3. Protect fresh concrete from direct rays of sun, rain, freezing, drying winds, soiling, and damage.
4. Do not permit curing method to affect adversely finishes or treatments applied to finish concrete.

B. Curing Method, Typical: Obtain the Architect's approval of alternate measures.

1. Keep forms and concrete surfaces moist during period forms are required to remain in place.
2. Apply curing compound per manufacturers' recommendations, except at slabs-on-grade apply curing compound at 150% of manufacturer's recommended application coverage rate.

### 3.05 CLEANING, PATCHING AND DEFECTIVE WORK

- A. Where concrete is under strength, out of line, level or plumb, or shows objectionable cracks, honeycombing, rock pockets, voids, spalling, exposed reinforcement, signs of freezing or is otherwise defective, and, in the Architect's judgment, these defects impair proper strength or appearance of the work, the Architect will require its removal and replacement at the Contractor's expense.
- B. Immediately after stripping and before concrete is thoroughly dry, patch minor defects, form-tie holes, honeycombed areas, etc., with patching mortar. Patch shall match finish of adjacent surface unless otherwise noted. Remove ledges and bulges.
- C. Compact mortar into place and neatly file defective surfaces to produce level, true planes. After initial set, dress surfaces of patches mechanically or manually to obtain same texture as surrounding surfaces.

D. Rock Pockets:

1. Cut out to full solid surface and form key.
2. Thoroughly wet before casting mortar.
3. Where the Architect deems rock pocket too large for satisfactory mortar patching as described, cut out defective section to solid surface, key and pack solid with concrete to produce firm bond and match adjacent surface.

E. Cleaning:

1. Insure removal of bituminous materials, form release agents, bond breakers, curing compounds if permitted and other materials employed in work of concreting which would otherwise prevent proper application of sealants, liquid waterproofing, and other delayed finishes and treatments.
2. Where cleaning is required, take care not to damage surrounding surfaces or leave residue from cleaning agents.
3. Remove all exposed, loose fibers from stair treads to the satisfaction of the architect.

**3.06 PROTECTION**

- A. Protect concrete from injurious action of the elements and defacement of any nature during construction operations.
- B. Protect exposed corners of concrete from traffic or use which will damage them in any way.
- C. Make provisions to keep all exposed concrete free from laitance caused by spillage or leaking forms or other contaminants. Do not allow laitances to penetrate, stain, or harden on surfaces which have been textured.

**3.07 FIELD QUALITY CONTROL**

A. The Owner's Testing Agency will:

1. Perform testing in accordance with ACI 318 and CBC Section 1704A.4, 1903A, 1905A and 1916A and Table 1704A.4.
2. Review concrete mix designs.
3. Inspect concrete and grout placement continuously.
4. Test concrete to control slumps according to ASTM C143.
5. Continuously monitor concrete temperature as it arrives on the site.
6. Test concrete for required compressive strength in accordance with CBC Section 1905A.6:
  - a. Make and cure four specimen cylinders according to ASTM C31 for not more than each 50 cubic yards, or 2000 square ft for of surface areas of slab or walls poured each day.
  - b. Retain one cylinder for 7-day test, two for the 28-day test and hold one cylinder for additional testing as required.
  - c. Number each cylinder 1A, 1B, 1C, 1D, 2A, 2B, 2C, 2D etc; date each set; and keep accurate record of pour each set represents.
  - d. Transport specimen cylinders from job to laboratory after cylinders have cured for 24-hours on site. Cylinders shall be covered and kept at air temperatures between 60 and 80 degrees Fahrenheit.
  - e. Test specimen cylinders at age 7-days and age 28-days for specified strength according to ASTM C39.
  - f. Base strength value on average of two cylinders taken for 28-day test.
7. Test and inspect materials, as necessary, in accordance with ACI 318, MM Test Method 227 (Coarse Aggregates) and MM Test Method 217 (Fine Aggregates), for compliance with requirements specified in this section.

- B. The Contractor shall:
1. Submit ticket for each batch of concrete delivered to job site. Ticket shall bear the following information:
    - a. Design mix number.
    - b. Signature or initials of ready mix representative.
    - c. Time of batching.
    - d. Weight of cement, aggregates, water and admixtures in each batch with maximum aggregate size.
    - e. Total volume of concrete in each batch.
    - f. Notation to indicate equipment was checked for contaminants prior to batching.
  2. Pay the Owner's Testing Agency for taking core specimens of hardened structure and testing specimen according to ASTM C88 and C42 when laboratory tests of specimen cylinders show compressive strengths below specified minimum.
  3. Submit Concrete Weighmaster affidavit per section 2.05 (B) 2.d.

### **3.08 FINISH OF FORMED SURFACES**

- A. Rough Form Finish: For formed concrete surfaces not exposed-to-view in the finish Work or by other construction. Concrete surface shall have texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4 inch in height rubbed down or chipped off.
- B. Smooth Form Finish: For formed concrete surfaces exposed-to-view, or to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, painting or other similar system. This is as-cast concrete surface obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams. Repair and patch defective areas with fins or other projections completely removed and smoothed.
- C. Related Unformed Surfaces: At tops of walls, horizontal offsets and similar unformed surfaces occurring adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

### **3.09 SLAB FINISHES**

- A. Scratch Finish: Apply scratch finish to monolithic slab surfaces that are to receive concrete floor topping or mortar setting beds for tile, portland cement terrazzo, and other bonded applied cementitious finish flooring material, and as otherwise indicated.
1. After placing slabs, plane surface to tolerances for floor flatness FF of 20 and floor levelness FL of 15. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set, with stiff brushes, brooms or rakes.
- B. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo, and as otherwise indicated.
1. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units. Check and level surface plane to tolerances for flatness FF of 25 and levelness FL of 20. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

- C. Trowel Finish: Apply trowel finish to monolithic slab surfaces to be exposed-to-view, and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or other thin film finish coating system.
  - 1. After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance. Check and level surface plane to tolerances flatness FF of 35 and levelness FL of 25. Grind smooth surface defects which would telegraph through applied floor covering system.
  - 2. Floors to receive traffic topping shall have steel trowel finish.
- D. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply trowel finish as specified, then immediately follow with slightly scarifying surface by fine brooming.
- E. Medium Broom Finish: For concrete slopes with less than 6% slope, apply medium broom finish to exterior concrete platforms, steps and ramps, and elsewhere as indicated.
  - 1. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.
  - 2. Along accessible routes of travel, finishes shall be (as defined by DSA):
    - a. Less than 6% slope: Provide medium salted finish
    - b. 6% or greater slope: Provide slip resistance finish.
- F. After completion of broadcasting and floating, apply trowel finish as herein specified. Cure slab surface with curing compound recommended by dry shake hardener manufacturer. Apply curing compound immediately after final finishing.

### **3.010 CLEAN UP**

- A. Perform Work under this Section to keep affected portions of building site neat, clean, and orderly. Remove, immediately upon completion of Work under this Section, surplus materials, rubbish, and equipment associated with or used in performance. Be aware that failure to perform clean-up operations within 24 hours of notice by Architect will be considered adequate grounds for having work done by others at no added expense to the Owner.

**END OF SECTION**

**SECTION 04 20 00**

**CONCRETE MASONRY UNITS**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section Includes: Provision of concrete masonry work, including but not limited to, masonry units, mortar, grout, reinforcing steel, control joints, testing and inspection.
- B. Related Sections:
  - 1. Section 03 20 00 - Concrete Reinforcement
  - 2. Section 03 30 00 - Cast-in-Place Concrete
  - 3. Section 05 12 00 - Structural Steel
  - 4. Section 07 19 00 - Water Repellant Coatings

**1.02 REFERENCES**

- A. Requirements of the GENERAL CONDITIONS and DIVISION NO. 1 apply to all Work in this Section.
- B. Published specifications, standards, tests or recommended methods of trade, industry or governmental organizations apply to Work in this Section where cited by abbreviations noted below (latest editions apply).
  - 1. California Code of Regulations, Title 24, Part 2, 2007 Edition, also known as California Building Code (CBC).
  - 2. American Concrete Institute's "Manual of Standard Practice for Detailing Reinforced Concrete Structures" (ACI 315).
  - 3. American Society for Testing and Materials (ASTM).
  - 4. "Specifications for Masonry Structures," ACI 530.1/ASCE6/TMS602.

**1.03 QUALITY ASSURANCE**

- A. All masonry work shall comply with the standards and requirements of the above references. Where discrepancies exist between the references and the Contract Documents, the requirements of the Contract Documents shall govern.
- B. Allowable Tolerances:
  - 1. Unit masonry shall be placed within 1/8-inch of dimensions noted.
  - 2. The maximum variation from plumb of walls shall be 1/8" in 20 feet.
  - 3. Joints shall have a uniform thickness of 3/8" unless otherwise noted. Joints shall not vary more than 1/16" in adjacent courses within two feet and shall not be less than 5/16" thick and not greater than 7/16" thick.
- C. Reinforcing Steel:
  - 1. Reinforcing steel shall not be permitted to rust where there is danger of staining exposed surfaces of adjacent concrete.
  - 2. The Contractor shall replace rust-stained concrete and/or masonry at no additional expense to the owner or project.
- D. Examination Criteria: All examinations, selections and approval shall be for the purpose of achieving a final installation of the unit masonry with the greatest possible uniformity of appearance and structural integrity based on the following criteria.

1. Testing and quality assurance measures outlined in this specification.
2. Color and texture shall match the approved mock-up for range, random variation and finish. The quality of construction shall match the approved mock-up.
3. Conformance to the contract documents and approved shop drawings within specified dimensions and tolerances.
4. Only one source for concrete masonry units shall be used throughout the work.
5. Other criteria as specified in this Section.
6. Non-conformance with any or all of the above criteria shall be grounds for removal and replacement of the work without expense to the Owner. The Architect shall determine if the work complies with the above criteria.

E. The Owner's Testing Agency will:

1. Collect plant certificates from the Contractor for concrete masonry units, stating that all units have been properly cured before shipment and that they conform to all the requirements of these specifications. All masonry units shipped without certification will be rejected.
2. Field test masonry unit moisture content prior to block installation. See Section 3.07, Field Quality Assurance.

#### 1.04 SUBMITTALS

- A. Manufacturer's literature: Submit manufacturer's literature describing products, including mix designs, history of compression tests, and mixing requirements as they apply to each different masonry unit, accessory and other manufactured product to be used in the unit masonry construction. Literature shall include, but not be limited to, preformed rubber control joints and all additives.
- B. Certificates:
1. Submit material certificates for the following signed by the manufacturer and the Contractor certifying that each material complies with requirements designated.
    - a. Each material and grade of reinforcing bars. See Section 03200, Concrete Reinforcement.
    - b. Each type and size of anchors, inserts, ties and accessories.
  2. The Contractor shall submit a certificate of compliance with the standards designated.
  3. Submit plant certificates for all concrete masonry units to the Owner's Testing Agency and Architect, stating that all units have been properly cured before shipment and that they conform to all requirements of these specifications.
- C. Mix Designs: Submit mix designs for mortar and grout, and history of compression tests. Submit manufacturer's literature for grout admixtures. Alternatively, proportions by mortar type shall be used as given in CBC Table 21A-A for mortar and Table 21A-B for grout.
- D. Unit Samples: Submit sample concrete masonry units in each color and texture combination specified.
- E. Samples: Submit samples of all accessories embedded in masonry.
- F. Mill Test: Submit mill test reports for all reinforcing steel.
- G. Extreme Weather Procedures: Submit cold and hot-weather construction procedures evidencing compliance with requirements specified in ACI 530.1 and these specifications.
- H. Shop Drawings: Coordination and shop drawings for all concrete masonry unit walls. Drawings shall consist of elevations and sections indicating materials and assembly, color surface finish, courses and reinforcing. Shop



drawings shall meet the following requirements:

1. The shop drawings shall illustrate detailing, fabrication, bending and placement of unit masonry reinforcing bars. Comply with ACI 315 showing bar schedules, stirrup spacing, diagrams of bent bars, and arrangements of masonry reinforcement. The shop drawings shall also indicate the location of all conduits, plumbing and other items embedded in unit masonry walls and coordinate this work with the placement of the unity masonry reinforcement.
  2. All shop drawings shall be drawn to scale.
- I. Test Reports: Submit material test reports indicating and interpreting test results relative to compliance with the tests described in this Section and Section 3.07 Field Quality Assurance.

#### **1.05 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Deliver and store packaged material in original containers with seals unbroken and labels intact until time of use.
- B. At the time of delivery to the site, masonry units shall conform to the linear shrinkage requirements of ASTM C90.
- C. Unload and inspect each masonry unit carefully and store on raised platform protected from weather so as to meet ASTM C90 requirements. Reject and remove from the site all material not conforming to specification requirements. In addition to lack of conformance to manufacturers' specifications, masonry units shall be rejected if:
  1. The color or texture of the concrete masonry units deviates from the range of colors and textures displayed on approved mock-up, as determined by the Architect.
  2. Concrete masonry units that are chipped, crack or otherwise damaged.
- D. Protect cementitious materials against exposure to moisture.
  1. Use of cementitious or other materials that have become caked and hardened from absorption of moisture will not be permitted.
- E. Prior to installation, unload concrete masonry units onto working pallets as described in Section 3.02, D.

#### **1.06 JOB CONDITIONS**

- A. Environmental Conditions:
  1. Do not place unit masonry when temperature is below 40 degrees Fahrenheit, unless the Architect approves and the Contractor provides means for preventing damage from freezing before and after placement.
- B. Protection:
  1. Protect surrounding work as required against damage from masonry work.
  2. Clean satisfactorily and correct damage to surrounding work resulting from masonry work.
  3. The contractor shall take all means and precautions necessary to protect masonry units from moisture absorption during shipping, storage on site, placement prior to grouting of wall, during wall construction until the masonry wall is completed and water repellent coating is applied.

## **PART 2 - PRODUCTS**

### **2.01 MATERIALS**

- A. Hollow Load-Bearing Concrete Masonry Units: As manufactured by Basalite, Calstone or approved equal. Medium weight (115 pcf) open end type concrete block size 8 x 8 x 16-inches or 12 x 8 x 16-inches, conforming to ASTM C90, (0.065 maximum allowable linear shrinkage). Minimum compressive strength of 3750 psi. Provide compressive strength indicated on drawings. The colors listed are Basalite. Submitted colors must match Basalite colors.
1. Class A - Precision Face; Color – TBD
  2. Class B – Split Face; Color - TBD
- B. Portland Cement: ASTM C150, Type II.
- C. Aggregates:
1. For Mortar: ASTM C144.
  2. For Grout: ASTM C404.
- D. Hydrated Lime; ASTM C207, Type S.
- E. Quick Lime: ASTM C5.
- F. Reinforcing Bars:
1. Bars: New billet steel, ASTM A615, Grade 60.
  2. Tie Wires: ASTM A82.
  3. Comply with the requirements of Section 03200, Concrete Reinforcement.
- G. Water: Clean and potable, free from impurities detrimental to mortar and grout.
- H. Control Joints: Preformed rubber in profiles required or shown. Same as Sonneborn-Contech's "Masonry Control Joints"; Dur-O-Wal National Inc.'s "Rapid Control Joint"; or equal product substituted per Section 01630.
- I. Mortar Coloring: Mineral oxide type, match to block color.
- J. Additives and Admixtures: Required in all grout to reduce early water loss to the masonry units and produce expansive action in the plastic grout to offset the initial shrinkage and promote bonding of grout to the interior masonry unit surfaces. Use Grout Aid by W.R. Grace or approved equal. Obtain approval of admixture by Architect, Structural Engineer and Owner's Testing Agency.
- K. Water Repellant Coating: As specified in Section 07190, Water Repellant Coating.

### **2.02 FABRICATION**

- A. Concrete Masonry Units: Blocks shall have been air cured for not less than 28 days.
- B. Reinforcement:
1. Shop-fabricate to comply with Drawings.
  2. Conform with requirements of ACI 315 where specific details are not shown or where Drawings and Specifications are not more demanding.

### 2.03 MIXES AND MIXING

#### A. Mortar:

1. Conform to ASTM C270, Type S.
  - a. Compressive Strength: Minimum 3,000 psi after 28 days.
  - b. Proportions by Volume: Shall be as shown in CBC Table 2103A.8(1).
  - c. Mortar Properties: Shall be as noted in CBC Table 2103A.8(2).
2. Mix in batch mechanical mixer permitting accurate control of water amounts. Place approximately half of the required water and sand into the mixer while turning. Add cement and remainder of the sand and water into mixer in that order and mix materials for at least three minutes with minimum of water to produce workable consistency. Site mixing of mortar shall not be permitted without review and acceptance of Contractor's procedure by the Owner's Testing Agency and the Structural Engineer.
3. Add lime and continue mixing as long as required to secure a uniform mass.
4. Total mixing time may not be less than 3 minutes or more than 10 minutes.
5. Use and place mortar in final position within 2½ hours after mixing.
  - a. Mortar that have stiffened as a result of evaporation of water may be re-tempered with water as frequently as required to restore required consistency during this time period.

#### B. Grout: Site mixing of grout shall not be permitted without review and acceptance by the Structural Engineer.

1. Compressive Strength: Minimum 1,500 psi after 28 days.
2. Slump: 9- to 10-inches.
3. Proportions by Volume: Shall be per CBC 2103A.12 or Table 2103A.12.
4. Use grout aid in all grout to reduce early water loss to the masonry units and produce an expansive action in the grout sufficient to offset initial shrinkage. Mix grout admixture in accordance with the manufacturer's recommendations and requirements.
5. Grout to comply with requirement of CBC 2103A.12 for materials and mixing requirements.
6. Use sufficient water to make a workable mix that will flow into all joints of the masonry units with typical rates of absorption for ASTM C90. The slump of the grout should be approximately 9 to 10 inches depending on temperature and humidity conditions.

#### C. General Mixing Requirements:

1. Measure materials accurately.
2. Shovel measurements will not be permitted.
3. Use mechanical mixer of at least one-sack capacity.
4. Completely empty drum before charging succeeding batch of materials.
5. Exercise extreme care in measuring ingredients for partial batches.
6. Comply with mixing requirements of CBC 1905A.8.

### 2.04 SOURCE QUALITY CONTROL

#### A. The Owner's Testing Agency will:

1. Collect mill test reports for reinforcements under Section 1.04.
2. Take samples of reinforcement and test per Section 03200, 1.03 (D).
3. Sample and test concrete masonry units for compressive strength, unit weight, absorption and moisture content in accordance with ASTM C140.
  - a. Compressive strength tests of units shall also comply with CBC 2105A.2.2.1.1.

4. Test for moisture content and drying shrinkage in accordance with ASTM C426.
5. Take and test Portland cement grab sample per Section 03300, 2.05(A)4.

### **PART 3 - EXECUTION**

#### **3.01 INSPECTION**

- A. Examine areas to receive masonry and verify the following:
  1. Foundation surface is level to permit bed joint within range of 1/4- to 3/4-inch.
  2. Edge is true to line to permit projection of masonry to less than 1/4-inch.
  3. Projecting dowels are free from loose scale, dirt, concrete, or other bond-inhibiting substances and properly located.
- B. Do not begin before unsatisfactory conditions have been corrected.

#### **3.02 PREPARATION**

- A. Clean concrete surfaces to receive masonry.
- B. Remove laitance or other foreign material lodged in surface by sandblasting or other means as required.
- C. Ensure masonry units are clean and free from dust, dirt, or other foreign materials before laying.
- D. Roughen concrete below walls to expose aggregate; remove loose particles and in hot weather dampen concrete surfaces before laying blocks. Contact surfaces of all foundations and floors that are to receive masonry work are to be mechanically roughened to 1/4" amplitude. Comply with CBC Section 1906A.4.
- E. Ensure random color variations in the installation of CMU. Unload from three delivered pallets onto a "working" pallet to be used for construction. Alternate among pallets when unloading to ensure a mix of CMU on the working pallet.

#### **3.03 REINFORCEMENT**

- A. Place bars where noted in accordance with ACI 315 and CBC 2103A.13.1 and do not disturb after start of masonry placement.
- B. All horizontal reinforcement shall be laid in bond beam units.
- C. Minimum clearance between bar and CMU is 1/2-inch and between parallel bars is 1-inch.
- D. Horizontal and vertical reinforcing shall be held in position by wire positioners or spacing devices near ends and at intervals not to exceed 200 bar diameters, and as required to prevent displacement by construction loads or placement of grout beyond the tolerances.

#### **3.04 PLACEMENT**

- A. General Requirements:
  1. Comply with CBC Section 2104A.6.1.1.2. High-lift grouting is not permitted.
  2. Ensure masonry units are sound, clean and free of cracking, chipping and broken edges at time of placement.
  3. Accurately cut and fit units as required to accommodate other work using masonry saws.
  4. Lay masonry units plumb, true to line, with level courses accurately placed.
  5. Adjust unit to final position while mortar is soft and plastic.

6. Align vertical cells accurately.
7. Remove units disturbed after stiffening of mortar, clean joints, and relay unit with fresh mortar.
8. In hot weather, moisten contact surfaces of the masonry units to receive mortar immediately before laying to prevent excessive drying of mortar.
9. Do not lay up one tier of wall more than 16-inches ahead of other tier.
10. Where necessary to stop longitudinal run, rack back one-half block length in each course.
11. Do not attach construction supports to walls, except where permitted by the Architect.
12. Install anchors, bolts, and other embedded items accurately as work progresses and prior to grouting.
13. Masonry installer and reinforcing steel installer shall meet and coordinate placement of reinforcing steel prior to placement of concrete or grout.

B. Joints:

1. Fill joints to thickness noted: Ensure full coverage of face shells in both horizontal and vertical joints and on webs.
2. Tool joints as specified on the drawings and achieve solid, smooth, watertight, compacted joints.
3. Joints Exposed to Weather: Point with pointing tools making solid, smooth, watertight joint well bonded to masonry at edges.
4. Immediately fill holes made by line pin with mortar when pin is withdrawn.
5. Remove surplus mortar from joints.

C. Cold Weather Requirements:

1. When daily temperature is below 40 degrees F., ensure reinforcing, masonry units, etc., contacting mortar, and grout are free of frost.
2. Protect all mortar and grout from freezing for at least 48 hours after installation whenever temperature falls below 40 degrees F.
3. Maintain mortar and grout at temperature no lower than 50 degrees F., while being used and until installed.
4. In freezing or near freezing weather, provide equipment of adequate size for heating of mortar and grout.
5. Do not add water to mix at temperature greater than 140 degrees F.

D. Hot Weather Requirements:

1. Implement the requirements of approved Hot Weather construction procedures when ambient air temperature exceeds 100 degrees F or 90 degrees F with a wind velocity greater than 8 mph.

E. Protection:

1. Protect face materials against staining.
2. Remove misplaced grout or mortar immediately.
3. Protect sills, ledges, offsets, and similar items from mortar drippings or other damage during construction.

F. Concrete Masonry Units:

1. Bond: Running bond, unless specifically noted otherwise.
2. Joint Thickness: 3/8-inch, both vertically and horizontally.
3. Joint Treatment:
  - a. Where exposed, all mortar joints shall be tooled joints.
  - b. Where concealed, cut off mortar flush with face of work using trowel.
4. Use single open-ended or double open ended beam units, typical. Use proper units to provide for windows, doors, bond beams, lintels, pilaster, etc., in order to minimize cutting.

5. Do not wet units.
6. Align vertical cells to provide continuous, unobstructed opening for grouting.
7. Corners: Provide standard masonry bond by overlapping units.

### **3.05 GROUTING**

#### **A. General Requirements:**

1. Use low-lift grouting procedure. High-lift grouting is not permitted. Do not pour grout until mortar has set and cured, 36 hours minimum. Grout walls as soon as possible after mortar has cured.
2. Grout voids between wythes and cells of concrete block.
3. Ensure grout flows into voids and completely surrounds reinforcing steel.
4. Stop grout approximately 1-1/2 inches below top of last course (1/2" at bond beams with horizontal steel), except at top course, bring grout flush with top of block.
5. Grout from inside face of masonry wherever possible.
6. Where necessary to stop longitudinal run, provide suitable dam to retain grout in place.
7. Do not wet down grout spaces prior to grouting.

#### **B. Low-Lift Grouting: Comply with CBC Section 2104A.6.1.1.2.**

1. Pour grout to a maximum height of 4-feet, stopping 1-1/2-inches below top of unit except at bond beam units with horizontal steel the grout shall be stopped 1/2-inch below top of unit.
2. Delay 3 to 5 minutes allowing the excess of water to be absorbed by the masonry unit, then consolidate by vibrating.
3. Layup and grout next 4-feet of walls.

### **3.06 POINTING AND CLEANING**

- A. Point holes or defective mortar joints upon completion of work; where necessary, cut out and repoint defective joints.
- B. At end of work day, fiber-brush new surfaces to remove mortar splashes, clean with mild detergent or enzymes, and rinse with clean water.
- C. Do not use acid solution to remove green stain or efflorescence resulting from salts; follow recommendations of manufacturer for removal of such stains.
- D. Upon completion of work, remove from site surplus materials, rubbish, and debris resulting from this work.

### **3.07 FIELD QUALITY ASSURANCE**

- A. Special Inspection: The Owner shall employ an approved, qualified masonry inspector to perform continuous masonry inspection per CBC 1701A. Special inspectors shall be prequalified by DSA. The masonry inspector shall be at the site during all masonry construction and perform the following duties:
  1. Review plans and specifications and meet with the Contractor to discuss requirements before work commences.
  2. Before masonry work commences, meet with the Contractor and the Architect in a joint meeting to review the requirements for surveillance and quality control of the masonry work.
  3. Check brand and type of cement, lime (if used) and source of sand.
  4. Inspect the foundation or slab to ascertain that it is clean and ready to receive units.
  5. Check reinforcing steel dowels for straightness, proper alignment, spacing, size and length.
  6. Observe manner in which units are laid up to ensure that joints are full of mortar and kept tight during work. Inspect cells to assure that fins will not interfere with grouting or foaming. Instruct masons to keep

- cells clean of mortar droppings and inspect to determine compliance.
7. Observe placing of grout continuously.
  8. Perform or supervise performance of required sampling and field testing as specified.
  9. Keep complete record of inspection of work. Report daily to the Owner's Representative the progress of the masonry inspection.
  10. Submit verified reports to DSA.
- B. Prism Test: The Owner's Testing Agency will perform prism testing in accordance with CBC Section 2105A.2.2.2.2.1 Prior to construction, a set of 5 masonry prisms shall be built using materials taken from those specified for this project. During construction test 3 prisms for each 5,000 sq. ft. of wall area and as additionally required by the Architect.
- C. Mortar and Grout Testing: The Owner's Testing Agency shall verify that mortar complies with the requirements of CBC 2103A.3.1 and CBC Table 21A-A. Compressive strength tests shall be performed on grout, one test for each 5,000 square feet of wall area. Test mortar and grout in accordance with CBC 2105A.5
- D. Masonry Core Tests: When required by the Owner or Architect, the Owner's Testing Agency shall take and test masonry cores in accordance with CBC 2105A.4. Take cores in locations designated by the Architect. Contractor shall restore walls with whole face shells or complete units as approved by the Architect. One half of the cores shall be tested for bond strength at the joint between the masonry and the grout.

**END OF SECTION**





**SECTION 05 12 00**

**STRUCTURAL STEEL**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section Includes: Provision of structural steel as indicated on the Contract Drawings. Work includes but is not necessarily limited to the following:
1. Structural steel framing, including all structural steel shown on the structural drawings and all standard shapes, plates and rods shown on the Architectural, Mechanical and Electrical drawings that connect to the building structure.
  2. Elevator rail bracing.
  3. Welded stud connectors for composite construction, concrete engagement, and attachment of building components.
  4. Anchor rods.
  5. Shop painting.
- B. Related Sections:
1. Section 03 20 00 - Concrete Reinforcement
  2. Section 03 30 00 - Cast-in-Place Concrete
  3. Section 05 31 00 - Steel Decking
  4. Section 05 50 00 - Metal Fabrications

**1.02 REFERENCES**

- A. Requirements of GENERAL CONDITIONS and DIVISION NO. 1 apply to all Work in this Section.
- B. Published specifications, standards, tests, or recommended methods of trade, industry, or governmental organizations apply to Work of this Section where cited by abbreviations noted below (latest editions apply).
1. California Code of Regulations, Title 24, Part 2, also known as the California Building Code (CBC), 2007 Edition.
  2. American Society for Testing and Materials (ASTM).
  3. American Institute of Steel Construction:
    - a. "Steel Construction Manual, Specification for Structural Steel Buildings, 2005, March 9, 2005, AISC 360" (AISC1).
    - b. "Code of Standard Practice for Steel Buildings and Bridges" (AISC2).
      - i. No provision of AISC2 shall be effective to change the duties and responsibilities of the Owner, Contractor or Structural Engineer from those set forth in these Contract Documents.
      - ii. Where discrepancies exist between the requirements of the Contract Documents and AISC2, the requirements of the Contract Documents shall govern.
    - c. "Seismic Provisions for Structural Steel Buildings, AISC-341" Dated March 9, 2005 and Supplement No. 1, Dated November 16, 2005 (AISC3).
  4. American Welding Society:
    - a. "Structural Welding Code -- Steel" (AWS D1.1).

- b. "Structural Welding Code – Seismic Supplement" (AWS D1.8).
  - c. "Structural Welding Code – Sheet Steel" (AWS D1.3).
  - d. "Standard Symbols for Welding, Brazing and Nondestructive Examination (AWS A2.4).
  - e. "Filler Metal Specifications" (AWS A5).
  - f. "Standard for AWS Certification of Welding Inspectors" (AWS QC1).
5. Society of Protective Coatings':
- a. Solvent Cleaning (SSPC-SP 1).
  - b. Hand Tool Cleaning (SSPC-SP 2).
  - c. Brush-Off Blast Cleaning (SSPC-SP 7).
6. Research Council on Structural Connections (RCSC) Specifications for Structural Joints using ASTM A325 or A490 Bolts.
7. American Society of Non-Destructive Testing:
- a. ASNT Standard for Qualification and Certification of Nondestructive Testing Personnel (ANSI/ASNT CP-189-2001).
  - b. Personnel Qualification and Certification in Nondestructive Testing, 2001 (ASNT Recommended Practice No. SNT-TC-1A).
8. Recommended Specifications and Quality Assurance Guidelines for Steel Moment-Frame Construction for Seismic Applications (FEMA-353).
9. American Iron and Steel Institute (AISI).

### 1.03 DEFINITIONS

- A. Demand-Critical Welds: Demand-Critical Welds are designated on the structural drawings. All Demand-Critical Welds are part of the Seismic-Load-Resisting System.
- B. Extra Smooth: Surfaces noted herein as "Extra Smooth" require a finish with surface variation of 500 micro-inches or less (AWS C4.1-77, Sample #4).
- C. Gouge: any depression deeper than the overall surface roughness.
- D. Heavy Sections: Rolled and built-up sections as defined below.
  1. ASTM A6 Group 3 shapes with flanges thicker than 1 ½".
  2. ASTM A6 Group 4 and Group 5 shapes.
  3. Welded built-up members with plates exceeding 2" in thickness,
  4. Column base plates exceeding 2" in thickness.
- E. Nondestructive Testing: Nondestructive testing (NDT) includes magnetic particle testing (MT), penetrant testing (PT), radiographic testing (RT), and ultrasonic testing (UT). The terms nondestructive examination (NDE) and nondestructive testing (NDT) are synonymous.
- F. Protected Zone: The Protected Zone is defined as structural members, or portions thereof, to which connections of structural and non-structural elements are limited. The Protected Zone is designated on the structural drawings.
- G. Quality Assurance Plan: The Quality Assurance Plan is set of the written requirements containing the set of procedures that are to be followed by the Owner's Testing Agency to confirm compliance with these requirements.

- H. Seismic-Load-Resisting System (SLRS): The Seismic-Load-Resisting System (SLRS) is defined as all items designated "SLRS" on the Structural Drawings, including columns, beams, and braces, and their connections along grid lines denoted "SLRS" on the framing plans.

#### 1.04 QUALIFICATIONS

- A. Steel Fabricator's Qualifications: Fabricator shall have had not less than 5 years' experience in fabrication of structural steel and be able to furnish evidence of his ability, facilities, proficiency of his personnel and completed projects.
- B. Steel Erector's Qualifications: Erector shall have had not less than 5 years' experience in erection of structural steel and be able to furnish evidence of his ability, facilities, proficiency of his personnel and completed projects.
- C. Welder Qualifications: Welders, welding operators, and tackers shall be qualified in accordance with AWS D1.1 and CBC Section 2231A.5.
1. Welders shall have a valid Welding Performance Qualification Record (WPQR) for each welding procedure to be performed.
  2. Welders whose work fails to pass inspection shall be requalified before performing further welding.
  3. Supplemental Welding Personnel Testing: Welders and welding operators performing work on bottom-flange Demand-Critical Welds shall pass Supplemental Welder Qualification Testing, as prescribed in FEMA 353, Part I, Appendix B, using the process and highest deposition rate to be used in the work. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification. Tack welders need not perform such Supplemental Testing.
  4. Qualification Period: Personnel who have not welded for a period of three or more months shall be requalified. Welding personnel required to be tested using the Supplemental Welding Personnel Testing shall be qualified by test within 12 months prior to beginning welding on the project.
  5. The Contractor shall pay costs of certifying qualifications and requalifications.

#### 1.05 QUALITY ASSURANCE

- A. Welding Inspector Qualifications:
1. All Welding Inspectors shall be trained and thoroughly experienced in inspecting welding operations, and qualified as Certified Welding Inspectors (CWI) in accordance with AWS D1.1 and AWS QC1.
  2. NDT Personnel Qualifications
    - a. NDT personnel shall be qualified under one of the ASNT documents referenced in this specification. NDT performed by NDT Level I personnel shall be under the close, direct supervision of an NDT Level II.
    - b. Demand-Critical Welds: UT may be performed only by UT technicians certified as Level II by their employer, or as ASNT Level III certified by examination by the ASNT. Ultrasonic testing technicians who perform flaw detection or sizing shall be trained in applicable UT procedure and shall demonstrate their competence through testing as prescribed in FEMA 353, Part I, Appendix E.
- B. Bolting Inspector Qualifications: Competency shall be demonstrated through the administration of a written examination and through the hands-on demonstration by the Inspector of the methods to be used for bolt installation and inspection.
- C. Submittals: The Owner's Testing Agency will submit the following items:
1. Quality Assurance Plan: The Quality Assurance Plan shall contain the Quality Assurance and

- Inspection items contained in this Section.
2. Qualifications of Owner's Testing Agency management and personnel designated for the project.
  3. Qualification records for Owner's Testing Agency's Inspectors and NDT technicians designated for the project.
  4. Owner's Testing Agency's Quality Control Plan for the monitoring and control of the Agency's operations.
  5. Written Practice for Owner's Testing Agencies: The Owner's Testing Agency shall maintain a Written Practice for the selection and administration of inspection personnel, describing the training, experience and examination requirements for qualification and certification of inspection personnel, including those of subcontracting agencies. The Written Practice shall also describe the Agency's procedures for determining the acceptability of the structure in accordance with the applicable codes, standards, and specifications. The Written Practice shall also describe the Agency's inspection procedures, including general inspection, material controls, visual welding inspection, and bolting inspection.
    - a. Bolting Inspection Procedures: Comply with RCSC Specification and the Quality Assurance Plan.
    - b. Welding Inspection Procedures: Meet the requirements of the AWS D1.1 and the Quality Assurance Plan.
    - c. Nondestructive Testing Procedures: The Written Practice shall describe the responsibility of each level of certification for determining the acceptability of material and welds in accordance with the applicable codes, standards, specifications and procedures.

#### **1.06 SUBMITTALS**

- A. The following items shall be submitted to the Architect for review. One reproducible copy will be returned. Do not fabricate material prior to obtaining final review of submittals.
  1. Manufacturer's test reports and literature describing products excluding those listed in Section 1.06B.
  2. Plans of all levels showing dimensioned location of edge of slab, deck, and openings. Submit prior to Shop and Erection drawings.
  3. Shop and Erection Drawings. Prior to the start of fabrication and erection, submit detailed shop and erection drawings for all structural steel showing:
    - a. Size and location of all structural members and connection material.
    - b. Type, size and location of bolts and welds.
    - c. Identification of high-strength bolted joints as snug-tight, pretensioned or slip-critical, as required by the Contract Documents.
    - d. Locations where the Construction Documents require backing bars to be removed.
    - e. Locations where the Construction Documents require supplemental fillet welds where backing is permitted to remain.
    - f. Locations where the Construction Documents require weld tabs to be removed.
    - g. Identification of members and connections of the Seismic-Load-Resisting System.
    - h. Location and dimensions of the Protected Zone.
    - i. Identification of welds in the Seismic-Load-Resisting System.
    - j. Identification of Demand-Critical Welds.
    - k. Identification of connections and members, or portions thereof, to be treated as AESS.
    - l. Shop and erection drawings shall clearly identify revisions and revision dates in accordance with AISC2.
    - m. Shop drawings shall include the following additional information:
      - i. Complete information necessary for the fabrication of members including cuts, copes, holes, stiffeners, and camber.

- ii. Surface preparation and finishes, including both painting and grinding.
  - iii. Material grades of all members, connection material, fasteners, and weld filler metal.
  - iv. Connection details drawn to scale for members of the Seismic-Load-Resisting System.
  - v. With each set of shop drawings include corresponding erection drawings identifying pieces.
- n. Erection drawings shall include the following additional information:
- i. Identification mark of members.
  - ii. Orientation and relation of members to appropriate grid lines.
  - iii. Setting elevations for column bases.
  - iv. Standard and special details for field connections.
  - v. Identification of joints or groups of joints in which a specific assembly order, welding sequence, welding technique, or other special precautions are required.
- o. Samples: Material samples shall be provided as requested by the Structural Engineer or Owner's Testing Agency.
- B. The following items shall be submitted to the Architect and Owner's Testing Agency. Submittal to the Architect is for record purposes only. No copies will be returned by the Architect.
1. Manufacturer's test reports and literature describing products:
- a. Structural Steel: Material test reports (MTRs), also called mill test reports, for all structural steel. MTRs shall comply with the requirements of ASTM A6. MTRs shall be accompanied by a Certificate of Compliance from the fabricator. Structural steel shall be identified in accordance with CBC Section 2203A.1.
  - b. Fastening Material: Manufacturer's Certifications for fastener components, including bolts, nuts, washers, and direct tension indicators (if used), accompanied by a Certificate of Compliance from the Contractor. Manufacturer certifications shall contain:
    - i. Heat analysis, heat number, and a statement certifying that prohibited elements were not added to produce the bolts.
    - ii. Results of hardness, tensile, and proof load tests, as required and performed.
    - iii. If galvanized, measured zinc coating weight or thickness, and the results of rotational capacity tests, including test method used (solid plate or tension measuring device) and lubricant present.
    - iv. Results of visual inspection for bursts.
    - v. Statement of compliance with dimensional and thread fit requirements.
    - vi. Lot number and purchase order number.
  - c. Welding Consumables: Submit the following items:
    - i. Manufacturer's Certifications for electrodes, fluxes and shielding gasses to be used. Certifications shall satisfy AWS A5 requirements. In addition submit a Certificate of Compliance from the Contractor supplying the materials. Submit certifications that the product meets any additional requirements of the project.
    - ii. Manufacturer's product data sheets for all welding material to be used. The data sheets shall describe the product, limitations of use, recommended welding parameters, and storage and exposure requirements, including baking and rebaking.
  - d. Welded Stud Connectors: Submit the following items:
    - i. Manufacturer's Certification that the studs, as supplied, meet the requirements of AWS

- D1.1.
  - ii. Certified copies of the stud manufacturer's test reports covering the last completed set of in-plant quality control mechanical tests for the diameter supplied.
  - iii. Certified material test reports from the manufacturer. The Manufacturer's Certification shall be accompanied by a Certificate of Compliance from the Contractor.
- 2. Bolting and Welding Procedures: Procedures shall assign responsibility to a person or position and shall contain enough detail to be useful to the workforce without reference to governing specifications. The procedures need not act as work instructions. Procedures shall be dated and indicate the person or position that has the authority to maintain the procedure.
  - a. Fastener Installation Procedures: Submit written procedures for the pre-installation testing, installation, snugging, pre-tensioning, and post-installation inspection of high strength fasteners.
  - b. Welding Procedure Specifications (WPSs): Welding Procedure Specifications (WPSs) shall conform to the requirements of AWS D1.1. Submit Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQR) as required by AWS D1.1, to be used on the project to the Owner's Testing Agency.
  - c. Use forms provided in Annex E of AWS D1.1 or equivalent.
  - d. Weld Sequence Procedures: Submit written procedures indicating field welding sequences for each type of connection with multiple field-welded joints, and the sequence of such connections to be field-welded at each level.
  - e. Weld Shrinkage and Distortion Control Plan: Where shrinkage is likely to cause distortion or other problems, submit a mitigation plan. The contractor is responsible for determining conditions requiring a Weld Shrinkage and Distortion Control Plan.
- 3. Welding Performance Qualification Records (WPQRs): Written Welding Performance Qualification Records (WPQRs), in accordance with AWS D1.1, for all welders on the project. Submit documentation that the welder has passed all designated supplemental welder qualification testing required for the types of welding to be performed. Submit documentation showing that the welder continued to use the applicable welding process on an ongoing basis since the WPQR test was conducted.

#### **1.07 STRUCTURAL STEEL PRE-CONSTRUCTION CONFERENCE**

- A. Prior to performing any fabrication or erection work, the Owner's Representative, Architect, Structural Engineer, and Owner's Testing Agency, together with Steel Fabricator personnel and Steel Erector personnel supervising the shop, field and Quality Control work shall hold a Pre-construction Conference to review submittal requirements, welding procedures, bolting procedures, fabrication and erection issues, and inspection requirements for all structural steel operations.

#### **1.08 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Deliver, store, and handle packaged materials in original containers with seals unbroken and labels intact until time of use.
- B. Structural steel shall be stored and handled in a manner that prevents damage or distortion. Discharge materials carefully; do not dump onto ground.
- C. Do not store materials on the structure in a manner that might cause distortion or damage to members of the supporting structure.
- D. Store structural steel members, whether on or off site, above ground on platforms, skids, or other support; store other materials in weather-tight, dry place until use.

- E. Store materials to permit easy access for inspection and identification.
- F. Electrode Requirements:
  - 1. Packaging of weld filler metals shall conform to the requirements of AWS D.1.1. FCAW electrodes shall be received in undamaged moisture-resistant containers. They shall be protected against contamination and injury during shipment and storage. When removed from protective packaging and installed on machines, care shall be taken to protect the electrodes and coatings from deterioration or damage.
  - 2. Modification or lubrication of an electrode after manufacture is not permitted, except that drying shall be permitted when recommended by the manufacturer.
  - 3. Electrode Storage and Exposure Limits for Demand-Critical Welds: The exposure time limit for FCAW electrodes shall be based upon the results of tests as prescribed in FEMA 353 Part I, Appendix D. Spools shall be identified to facilitate monitoring of total atmospheric exposure time. FCAW electrodes that have been exposed for periods exceeding the allowable atmospheric exposure may be baked as per D1.1 if manufacturer's testing and recommendations show that baking is effective.
- G. Fasteners shall be stored in a protected place. Except for ASTM F1852 "twist-off" type assemblies, clean and relubricate bolts, nuts and washers that become dry or rusty before use. F1852 fastener components may be relubricated following the manufacturer's written instructions, and must be retested after relubrication and prior to use to verify suitability for installation.

#### **1.09 JOB CONDITIONS**

- A. Provide the Owner's Testing Agency with free access to places on and off job site where materials are stored or fabricated, to places where equipment is stored or serviced, and to job site.
- B. Sequencing, Scheduling:
  - 1. Notify the Architect and Owner's Testing Agency in sufficient time prior to shop or field fabrication and erection to permit testing and inspection without delaying Work.
  - 2. Ensure timely delivery of items to be embedded in work of other sections; furnish setting drawings and directions for installation
  - 3. Provide templates for setting of anchor rods.

### **PART 2 - PRODUCTS**

#### **2.01 MATERIALS**

- A. Steel Shapes, Plates, Tube, Pipe, and other sections: As noted on drawings.
- B. Heavy Sections:
  - 1. Heavy Sections in the Seismic-Load-Resisting System shall be supplied with Charpy V-notch (CVN) testing in accordance with AISC3 requirements.
  - 2. Plates and Flanges in Heavy Sections shall be free of laminations within 3" of areas to be welded with complete-joint-penetration welds.
- C. High Strength Bolts, Nuts, and Washers:
  - 1. ASTM A325-N, snug-tight, unless otherwise noted.
  - 2. Bolted joints in the Seismic-Load-Resisting System shall be Slip-Critical, with pretensioned high-strength bolts and a Class A faying surface or better.

3. Twist-off-Type Tension-Control Bolt Assemblies: ASTM F1852.
4. Direct Tension Indicators: Load Indicator Washers: ASTM F959
5. Nuts for High Strength Bolts: ASTM A563.
6. Washers for High Strength Bolts: ASTM F436.

D. Welding materials:

1. Comply with AWS D1.1 with a nominal 70 ksi tensile strength.
2. Supplemental Requirements for the Seismic-Load-Resisting System (SLRS or LFRS):
  - a. Toughness and Elongation: Weld filler metals shall be capable of providing welds with the following minimum mechanical property requirements using AWS A5 classification test methods:
    - i. CVN toughness of 20 ft-lb at minus 20° F
    - ii. Elongation: 22% minimum.
  - b. Weld filler metals shall be low-hydrogen per AWS D1.1.
  - c. Weld procedures shall conform to the Hydrogen Control Method in AWS D1.1 Annex XI.
3. Demand-Critical Welds: In addition to the requirements for Seismic-Load-Resisting System welds, employ weld filler metals capable of providing welds with a minimum CVN toughness of 40 ft-lb at 70° F, using AISC3, Appendix X test conditions and specimens in lieu of those in AWS A5.

E. Welded Stud Connectors:

1. Headed Shear Studs: AWS D1.1 "Type B" automatic end-welded headed studs made from ASTM A108, Grade 1015 or 1020.
2. Threaded Studs: Automatic end-welded threaded studs made from ASTM A108, Grades 1010 through 1020.

F. Anchor Rods and Nuts: ASTM F1554; Grade as noted on drawings.

1. Grade 55 shall be weldable per supplement S1.
2. Grades 55 shall have a minimum CVN toughness of 15 ft-lbs at 40° F per supplement S4.
3. Grade 105 shall have a minimum CVN toughness of 15 ft-lbs at -20° F per supplement S5.

G. Primer:

1. Interior steel: primer shall conform to SSPC Paint Specification No. 13.
2. Exterior steel: primer shall conform to SSPC Paint Specification No. 20 (Zinc-Rich Primer)
3. Primers shall contain no lead or chromates.
4. Contractor shall verify compatibility with finish paint.

H. Zinc-Rich Coating for Repair of Galvanized Surfaces: Zinc-rich coatings shall meet the requirements of ASTM A780.

I. Steel shall conform to the requirements of CBC Section 2202A.1.

## 2.02 FABRICATION

A. General Requirements:

1. Fabricate structural steel in accordance with AISC1 (Chapter M and the first paragraph of J2.), AISC2, and AWS D1.1 as applicable to Statically Loaded Structures, except as otherwise noted



herein.

- a. Assume all thermally cut edges are subject to tension stresses.
  - b. Delete paragraphs M4.6 and M5.1 from Chapter M of AISC1.
2. Fabricate and assemble work in shop to greatest extent possible.
  3. Where possible, use procedures that do not require Architect's approval. Such approval may not be given in some circumstances.
  4. Coordinate as required for attachment of other work to structural steel.
  5. Where required for passage of reinforcing steel shapes, sections, plates, or bars, drill or punch holes as indicated on Contract Drawings. Notify Architect of conditions not shown or noted.
  6. Allowable Tolerances: Comply with AISC1, Chapter M, and AISC2, Section 6. Where more restrictive tolerances are necessary to properly install other building systems and components then adopt the more restrictive tolerances.
  7. Architecturally Exposed Structural Steel (AESS): All structural steel denoted "AESS" on the drawings shall be fabricated in accordance with the requirements of Section 05125 of the Specifications.
  8. Holes and attachments to structural steel in areas designated as the Protected Zone are not allowed except as explicitly shown or noted on structural drawings.

B. Connections:

1. Shop Connections: Bolted or welded as noted.
2. Field Connections: Locate splices only where noted or approved by Architect.
3. To the extent possible, assemble structural steel in the shop prior to galvanization.

C. Bolted Joints:

1. Punch or drill holes 1/16" larger than bolt size. Material having thickness in excess of connector diameter plus 1/8" shall be drilled rather than punched.
2. Ream unfair holes, but only up to next larger bolt size and install a bolt corresponding to the new hole size. Where unfairness exceeds maximum, weld hole in base material solid and drill hole of proper size.
3. Remove burrs that would prohibit solid seating of connected parts.
4. Mark completely tightened bolts with identifying symbol.
5. Provide hardened washers over slotted holes.
6. Draw up tight, check threads with chisel or provide approved lock washers where bolts are not pretensioned.
7. Assembly with Standard Threaded Fasteners: Provide beveled washers under bolt heads or nuts resting surfaces exceeding five percent slope with respect to head or nut
8. Assembly of High-Strength Structural Bolted Joints:
  - a. Meet requirements of RCSC.
  - b. Seismic-Load Resisting System joints shall be slip-critical (friction-type) as defined in RCSC with Class A or better faying surfaces.
  - c. Provide hardened washers under provided under the element turned in the tightening procedure of high strength bolts.
  - d. Direct tension indicator washers, where used, shall be provided under the head of slip-critical high strength bolts.

D. Welded Construction: (shop and field)

1. Weld in accordance with AISC1, AWS D1.1, and CBC Chapter 22.
2. Welding shall be performed in accordance with the WPS for the joint.

3. Welds that will be permanently exposed to view shall have burrs, flux, welding oxide air spots, and discolorations removed. Surfaces of such welds shall be reasonably smooth and uniform.
4. Exterior welds shall be watertight.
5. Exposed welds in AESS shall be ground, dressed smooth, and flush with adjacent surfaces where required by Section 05125.
6. Each welder working on the project shall be assigned an identification symbol or mark. Each welder shall mark or stamp this identification symbol at each weld completed. Stamps, if used, shall be the low-stress type.
7. Before testing, all welds to be subjected to ultrasonic testing (UT) shall be given a visible mark, "for UT," accurately placed on the steel a distance of 4" away from the root of the edge preparation.
8. Groove welds shall be complete-joint-penetration welds, unless specifically designated otherwise.
9. WPSs shall be available to welders and inspectors prior to and during the welding process. Prior to welding, joint fit-up shall be verified by the welder for conformance with the WPS and AWS D1.1.
10. Supplemental Welding Requirements
  - a. Maximum Preheat and Interpass Temperature: The maximum preheat and maximum interpass temperature permitted is 550° F, measured at a distance of 1" from the point of arc initiation. This maximum temperature may not be increased by the WPS, regardless of qualification testing.
  - b. Nonfusible Backing: The use of nonfusible backing materials, including ceramic and copper, is permitted only with satisfactory welder qualification testing performed using the type of backing proposed for use and using the test plate shown in AWS D1.1, Figure 4.21, except that groove dimensions shall be as provided in the WPS and PQR. For nonfusible weld tabs and short segments of nonfusible backing bars used at the ends of welds between shear plates and column faces, or at the ends of continuity plate welds, special welding personnel and welding procedure qualification testing is not required.
  - c. Peening, Controlled Cooling, and Post-Weld Heat Treatment (PWHT): If peening, controlled cooling, or PWHT are used, they shall be performed in accordance with AWS D1.1 and a written procedure for their performance shall be incorporated into the appropriate WPS.
    - i. If insulating blankets are used to control cooling a written procedure and temperature measurements are not required.
    - ii. The application of heat immediately following completion of a joint to maintain a nominal temperature at or below 550° F is not considered PWHT.
  - d. Intermix of Filler Metals: For Demand-Critical Welds in which different weld filler metals are used, supplemental toughness testing shall be conducted as prescribed in FEMA 353, Part I, Appendix C.
  - e. Wind Velocity Limits: In the Seismic-Load-Resisting-System, in lieu of the wind speed limitations in AWS D1.1, welds using GMAW, FCAW-G, GTAW and EGW methods shall not be performed when the wind velocity in the immediate vicinity of the weld exceeds three miles per hour. Welding performed within an enclosed area, and not subject to drafts may be deemed to satisfy this requirement. For SMAW, FCAW-S, and SAW processes wind shall not affect the appearance of the molten weld puddle.
11. Welded Joint Details:
  - a. Backing bars: The use of backing bars shall be in accordance with AWS D1.1. Backing bars shall be removed where required by the Contract Documents or AWS D1.1.
    - i. Heavy Section Splices Requiring Removal of Backing Bars: All welded splices of Heavy Sections, shall have the backing bars removed. Where fusible backing material is used, the root pass area shall be backgouged after backing bar removal, and backwelded until flush

- or with slight reinforcement. The surface shall then be ground Extra Smooth.
- ii. Beam-Column Connection Joints Requiring Removal of Backing Bars: Following removal of backing, remove un-sound weld metal at the root area and any excessive weld discontinuities, and backweld. Minimize gouging and removal of base metal. A reinforcing fillet weld with a minimum leg size of 5/16" or the root opening plus 1/16", whichever is larger, shall be provided. Perform MT on the fillet weld and the immediately adjacent area.
  - iii. If groove weld backing is permitted to remain, the backing shall not exceed 3/8" thickness. For connections of the seismic-load-resisting system in which backing is not removed, backing shall be attached to the member or plate that does not have its surface prepared for the groove weld. Attachment shall be by either a 1/4" fillet or 1/8" groove weld along the complete bar length on the side of the bar opposite the groove weld.
- b. Weld dams are not allowed.
  - c. Weld Tabs:
    - i. Use of Weld Tabs: Welds shall be terminated at the end of a joint in a manner that will ensure sound welds. Whenever necessary, this shall be done by use of weld tabs.
      - 1) Weld tabs shall extend beyond the edge of the joint a distance equal to a minimum of the part thickness, but not less than 1".
      - 2) Weld tabs shall be oriented parallel to the joint preparation and to the weld direction.
      - 3) Nonfusible weld tabs may be used in applications and locations where qualified in accordance with AWS D1.1, Section 4.
    - ii. Heavy Section Joint Weld Tab Removal and Finish: All welded tension splices in Heavy Sections, shall have the weld tabs removed and ground Extra Smooth.
    - iii. SLRS Beam-Column Connection Weld Tab Removal and Finish:
      - 1) Weld tabs of SLRS connections shall be removed. Removal may be performed by air carbon arc cutting (CAC-A), grinding, chipping, or thermal cutting to within 1/8" of the base metal surface. For continuity plate weld tabs, removal within 1/4" of the plate edge is adequate. The process shall be controlled to minimize removal of base metal except for that material immediately adjacent to the weld. The edges where the weld tabs have been removed shall be finished Extra Smooth.
      - 2) In SLRS connections, gouges deeper than 1/16" at locations of removal of weld tabs shall be repaired by welding according to the requirements of this Specification for Deep Gouges. Weld filler metal requirements for Demand-Critical Welds apply. The contour of the weld at the ends shall provide a smooth transition, free of gouges and sharp corners. A minimum radius at the corner need not be provided.
      - 3) Following weld tab removal, finishing, and completion of any necessary repairs, the exposed ends of the weld shall be inspected using magnetic particle testing (MT) or Penetrant Testing (PT).
  - d. Weld toes: Weld toes, whether for groove welds or fillet welds, shall provide a smooth transition between the weld and base metal. The as-welded profile is adequate provided it satisfies the criteria of AWS D1.1, Section 5.24.
  - e. Weld access holes:
    - i. Weld access holes shall meet the dimensional, surface finish, and testing requirements of AISC1 Chapter J1.6 and AWS D1.1, except as otherwise required by the Contract Documents.
    - ii. Where the height of the weld access hole exceeds the quantity  $k-tf+1\frac{1}{2}$ " or where the length of the weld access hole exceeds 4 tf (where k and tf are defined in AISC1), welded

- reinforcement is required. Notify the Architect for specific instruction.
- iii. At welded flange joints that are part of the Seismic Load Resisting System, the weld access hole detail shown in Figure 11-1 of the AISC3 shall be used unless the section is a Heavy Section.
  - iv. The SLRS access hole shall be ground Extra Smooth. Gouges at SLRS access holes shall be repaired according to the requirements of this Specification. Weld filler metal requirements for the Demand-Critical Welds apply.
  - v. SLRS weld access holes shall be inspected using magnetic particle testing (MT) or liquid penetrant testing (PT) and shall be free of cracks. If a welded gouge repair has been performed, magnetic particle testing (MT) shall be performed.
- f. Web weld details: A minimum clear distance of ½” shall be provided between the weld access hole and fillet welds connecting the shear plate and beam web.
  - g. Welding for Moment Connection of Bottom Beam Flange shall be sequenced so as to minimize residual stresses in the joint.
  - h. Weave Passes: Weave passes are not permitted in groove welds in the SLRS.
  - i. Column continuity plate details:
    - i. If backing bars are used and remain in place, they shall receive a reinforcing fillet weld between the backing bar and column flange. No fillet weld should be placed between backing bar and continuity plate.
    - ii. Weld terminations near the end of the column flange tips may be completed using weld tabs. Weld tabs shall be removed to within ¼” of the continuity plate edge and the surface finished Extra Smooth. Following finishing, the edge shall be inspected using MT. For continuity plate welds, terminations near the internal radius of the member need not be made using weld tabs. Fillet weld terminations between the continuity plate and column web shall be approximately ¼” from each end of the joint
  - j. Tack Welds in the SLRS Protected Zones: Tack welds in the SLRS Protected Zones are permitted only if they are incorporated into a required weld.
- E. Reduced Beam Sections (RBS):
- 1. RBS Cut Tolerances: The tolerance on the width of each RBS cut is plus or minus ¼,” measured at the mid-thickness of the flange at the narrowest point of the cut flange. The length of the cut shall be within plus or minus 15% of the specified length. The width of cut on each side shall have no more than ⅜” total variation in the width of cut from one side to the other. (Example: plus ⅛” on one side, minus ¼” on other side.) RBS width shall be as measured after the repair of Gouges.
  - 2. Cut Surface Roughness: RBS cut surface shall be Extra Smooth. Corners between the cut RBS surface and the top and bottom of the flanges shall be ground to remove sharp edges.
  - 3. Gouges that occur in the RBS cut shall be repaired. Weld filler metal requirements for Demand-Critical Welds apply. The transitional slope of any area where gouges have been removed shall not exceed 1:10. MT testing of repaired area is required. Gouges ½” or more in depth shall be cause for rejection of the beam.
- F. Heavy Sections:
- 1. General: See AISC1 Chapter A3.1c for materials requirements.
  - 2. Applicability of Provisions: All requirements of AISC1 for Group 4 and 5 shapes shall apply to Heavy Sections as defined in this Specification.
  - 3. Access Hole Requirements: Access holes shall conform to the requirements of AISC1, Chapter J1.6. Weld access holes must be preheated to a minimum of 150° F prior to thermal cutting, ground to an Extra Smooth finish. Inspect holes for cracks using either penetrant testing (PT) or magnetic particle

- testing (MT). Optionally, weld access holes may be made by drilling and saw-cutting without grinding, but PT or MT of the cut surface is still required.
4. Welding: The minimum preheat and interpass temperature shall be as specified by AISC1, Chapter J2.8. Weld tabs and backing bars shall be removed, ground to an Extra Smooth finish, with reinforcement not to exceed 1/8", at a transition slope not to exceed 1:10. See AISC1 J2.8 for preheat requirements and J1.5 for weld tab and backing bar removal requirements.
  5. Splices shall conform to the requirements of AISC1, Chapter J1.5
- G. Camber: Provide camber as indicated on contract drawings in accordance with AISC1 Chapter M2.1.
- H. Welded Connectors: Install in accordance with AWS D1.1 and manufacturer's recommendations. There shall be no porosity or evidence of lack of fusion between the end of the stud and the steel member.
- I. Repair of Discontinuities in Protected Zone of Seismic-Load-Resisting System.
1. Repair of Discontinuities: If erection aids within the Protected Zone cannot be avoided, the Structural Engineer's approval of the aid's placement, use, and the repair method is required. Air carbon arc gouging is permitted for the removal of welds to within 1/8" of the base metal surface. Any remaining weld deposits shall be removed by grinding to a depth 1/16" below the surface, faired to adjacent surfaces on a slope not to exceed 1:5.
  2. Air Carbon Arc Cutting and Thermal Cutting: Air carbon arc cutting (CAC-A) and thermal cutting is permitted in the Protected Zone with the prior approval of the Structural Engineer for the removal of backing bars and weld tabs, as specified in these documents.
  3. Gouges in members and connections in the Seismic-Load-Resisting System shall be repaired according to the requirements of this Specification. Weld filler metal requirements for the Seismic-Load-Resisting System apply, unless otherwise noted.
- J. Surface Finish
1. Flush Surfaces: Welds in butt joints required to be flush shall be finished so as to not reduce the thickness of the thinner base metal or weld metal by more than 1/16", or 5% of the material thickness, whichever is less. Remaining reinforcement shall not exceed 1/32" in height. However, all reinforcement shall be removed where the weld forms part of a faying or contact surface. All reinforcement shall blend smoothly into the plate surfaces with the transition areas free from undercut.
  2. Finish Methods and Values: Chipping and gouging may be used, provided these methods are followed by grinding. Where surface finishing is required, surface shall be Extra Smooth, unless otherwise noted or specified in this document. Measurement of surface finish values by visual appearance or tactile comparison is acceptable.
- K. Repair of Gouges: Gouges are not permitted in areas requiring an Extra Smooth finish surface, or where specifically prohibited by AWS D1.1 or this Specification. Repair of gouges meet the following requirements, unless otherwise noted:
1. Shallow Gouges: Gouges up to 3/16" deep shall be removed by grinding as per D1.1, or to a radius of not less than 3/8".
  2. Deep Gouges: Gouges deeper than 3/16" shall be repaired by welding. Prior to welding, gouges shall be ground to provide an Extra Smooth contour with a radius not less than 3/8". The repair area shall be preheated to a temperature between 400° F and 550° F, measured at the point of welding approximately one minute after removal of the heating source, or shall be preheated in accordance with AWS D1.1 Annex XI for high restraint. A written repair WPS for the application shall be followed. Following completion of welding, the area shall be ground Extra Smooth, with fairing of the welded surface to adjoining surfaces where applicable, and shall be inspected using magnetic particle testing (MT).
  3. The transitional slope after gouge removal shall not exceed 1:5.

## 2.03 FINISHES

### A. Prime Painting

1. Surfaces to be painted:
  - a. Apply one coat of exterior primer to structural steel surfaces permanently exposed to weather.
  - b. Apply one coat of interior primer to structural steel in areas without environmental controls such as bridges between buildings, open-air stair wells, and unoccupied areas with rat slabs.
  - c. Apply one coat of primer to AESS members and members to be painted unless otherwise noted.
  - d. Do not prime paint following surfaces:
    - i. Surfaces to be encased in concrete except initial 2".
    - ii. Surface to be field welded.
    - iii. Surface to receive sprayed-on fireproofing.
    - iv. Contact surfaces joined by high-strength bolts.
2. Preparation of Surfaces:
  - a. Thoroughly clean mill scale, rust, dirt, grease, and other foreign matter from steel prior to painting.
  - b. Where hand-cleaning methods are inadequate, clean in accordance with SSPC-SP1, SSPC-SP 2, or SSPC-SP 7, as required.
3. Painting:
  - a. Apply primer in accordance with manufacturer's specifications to provide minimum dry film thickness of 1.0 mils per coat.
  - b. Permit thorough drying before shipment.
  - c. Do not prime in temperatures lower than 45 degrees Fahrenheit.

### B. Galvanization

1. Galvanize steel where required by the Drawings or by other sections of the Specification.
2. Galvanize Shapes in accordance with ASTM A153.
3. Galvanize Fasteners in accordance with ASTM B695, Class 40 minimum.

## 2.04 SOURCE QUALITY ASSURANCE

### A. The Owner's Testing Agency will:

1. Review ladle analysis and certificates of compliance. Where certification is questionable, test material to verify compliance per CBC Section 2212A.1.
2. Inspect shop fabrication per CBC Section 1704A.2 and 1704A.3.2.1.
3. Provide the management, personnel, equipment, and services required to perform the quality assurance functions required below.
4. Verify that no improper attachments to the Protected Zone have been made.
5. Inspect Heavy Sections:
  - a. Heavy Section flanges shall be ultrasonically examined at locations to be groove-welded, for evidence of laminations, inclusions, or other discontinuities, in accordance with ASTM A898, Straight Beam Ultrasonic Examination of Rolled Steel Structural Shapes. Examination shall include entire area within 3" of such joints.
  - b. For plates, ultrasonically examine in accordance with ASTM A435, Straight Beam Ultrasonic

- Examination of Steel Plates. Any discontinuity causing a total loss of back reflection that cannot be contained within a circle with a diameter of the greater of 3" or one-half the plate thickness shall be rejected.
- c. A reinspection shall be done a minimum of 48 hours after welding on flanges at SLRS moment connections with a thickness of 3" or greater.
6. Forward copies of all product and procedure certificates, data sheets, and test and inspection reports to the Owner, Architect, Structural Engineer, and, Contractor, and DSA.
- B. Welding Inspection: The Welding Inspector will perform the tasks indicated in the following list. This list shall not be considered exclusive of any additional inspection tasks that may be necessary to meet the requirements of AWS D1.1, CBC Section 1704A.3.1, and the Quality Assurance Plan
1. Review and understand the applicable portions of the specifications, the Contract Documents and the shop drawings for the project.
  2. Verify that all applicable welder qualifications, welding operator qualifications and tack welder qualifications are available, current, accurate, and in compliance with these specifications.
  3. Verify welder identification and qualification. Verify that any required supplemental welder qualification testing, if required for the joint, has been executed and that the welder has passed.
  4. Verify that each welder has a unique identification mark or die stamp to identify welds.
  5. Verify that all applicable Welding Procedure Specifications (WPSs), with Procedure Qualification Records (PQRs) as needed, are available, current and accurate, and comply with AWS D1.1 and this specification.
  6. Verify that an approved Welding Procedure Specification (WPS) has been provided and that each welder performing the weld has reviewed the WPS. A copy of the appropriate WPS shall be available for each joint, although need not be present at each joint location.
  7. Review mill test reports for all main member and designated connection base material for compliance with the project requirements.
  8. Verify base material identification with the contract documents.
  9. Verify the electrode, flux and shielding gas certifications for compliance with the Contract Documents.
  10. Verify welding consumables with the approved WPSs.
  11. Verify that electrodes are used only in the permitted positions and within the welding parameters specified in the WPS.
  12. Verify that electrodes and fluxes are properly stored, and that exposure limits for the welding materials are satisfied.
  13. At suitable intervals, observe joint preparation, assembly practice, preheat temperatures, interpass temperatures, welding techniques, welder performance and any post-weld controlled cooling and heat treatment to ensure that the requirements of the WPS and AWS D1.1 are satisfied.
  14. At suitable intervals, verify current and voltage of the welding equipment in application of the WPS, if needed, by a calibrated amp and voltmeter. Current and voltage shall be measured near the arc with this equipment.
  15. Inspect the work to ensure compliance with AWS D1.1 and the specified weld acceptance criteria.
  16. Schedule NDT technicians in a timely manner, after the visual inspection is complete and the assembly has cooled. The final NDT on a specific weld shall be performed at least 24 hours after the welding has been completed.
  17. Mark the welds, parts, and joints that have been inspected, and accepted, with a distinguishing mark or die stamp, or maintain records indicating the specific welds inspected and accepted by each inspector.
  18. Document the accepted and rejected items in a written report. Transmit the report to the designated recipients in a timely manner.
- C. Nondestructive Testing of Welded Joints

1. Magnetic Particle Testing: Magnetic Particle Testing (MT) shall be conducted by the Owner's Testing Agency at the frequency designated in Table 2-1. MT shall be performed in accordance with AWS D1.1, and FEMA 353, Part I Appendix F.
2. Ultrasonic Testing: Ultrasonic testing (UT) shall be conducted by the Owner's Testing Agency for the percentage of joints designated in Table 2-1. UT shall be performed in accordance with AWS D1.1.
3. Weld Acceptance Criteria shall be in accordance with AWS D1.1. Regions of welds that cannot be inspected shall be identified and recorded, and the Structural Engineer shall be notified.
4. K-Area Welding Inspection: After welds of continuity plates and doubler plates have cooled to ambient temperature, test column webs for cracking using liquid penetrant (PT) or magnetic particle testing (MT) over a zone 3" above and below each weld.

D. Table 2-1: Nondestructive Testing Requirements

Weld Category	Nondestructive Testing Requirements	
	Complete-Joint-Penetration Welds <sup>1</sup>	Partial-Joint-Penetration Welds and Fillet Welds
Welds not described below	No NDT required unless otherwise noted	No NDT required unless otherwise noted
SLRS welds not described below	MT 25% of joints, full length <sup>2</sup> UT 25% of joints, full length <sup>2</sup>	MT 25% of joints, 6" spot at random <sup>2</sup>
Top-flange joints at cantilever beam connections <sup>3</sup>	MT 100% of joints, full length UT 100% of joints, full length	MT 100% of joints, full length
Demand-Critical Welds; Butt joints in column splices	MT 100% of joints, full length UT 100% of joints, full length <sup>4</sup>	MT 100% of joints, full length

Notes:

1. UT is required only when the weld thickness is 5/16" or greater.
2. If any joint fails testing, test 100% of joints until 40 consecutive welds pass. The testing rate may then be reduced to 25%.
3. Test joint on each side of cantilever beam support.
4. Reduce the rate of UT to 25% if after 40 welds have been inspected, an individual welder's reject rate is less than 5%.

**PART 3 - EXECUTION**

**3.01 INSPECTION**

- A. Examine units of Work to be placed and verify that all anchor rods have been installed properly and have sufficient bolt and thread elevation.
- B. Do not begin erection before unsatisfactory conditions have been corrected.

**3.02 ERECTION**

- A. General Requirements:
  1. Erect structural steel in accordance with AISC1 Chapter M, AISC2, and AWS D1.1 Structural Steel Welding Code as applicable to Statically Loaded Structures.
  2. Requirements for bolted and welded joints specified in Part 2 of this Specification shall also apply to



- field connections unless otherwise noted.
3. Erection Tolerances: Do not exceed the erection tolerances specified in AISC2, Section 7. Where more restrictive tolerances are necessary to properly install other building systems and components then adopt the more restrictive tolerances.
  4. Where erection requires performing work of fabrication on site, conform to applicable standards for fabrication.
  5. Architecturally Exposed Structural Steel (AESS): All structural steel denoted "AESS" on the drawings shall be erected in accordance with the requirements of Section 05125 of the Specifications.
  6. Ensure steel is plumb, level, and aligned before making final connections.
- B. Anchor rods shall be set in conformance with Section 7.5 of AISC2.
- C. Field Cutting or Alteration: There shall be no field cutting, alteration, or repair of structural steel members or of connections without prior review and approval by the Architect. Structural elements with fabrication errors or that do not satisfy tolerance limits shall be repaired. Submit drawings showing reasons for, and details of, proposed corrective work.
- D. Temporary Shoring and Bracing: Provide shoring and bracing as needed until permanent lateral-support is in place and complete with connections of sufficient strength to bear the imposed loads. Contractor is responsible for identifying the need for temporary shoring and bracing.
- E. Erection Procedures: Control erection procedures and sequences to avoid problems caused by temperature differentials and weld shrinkage, and other sources of expansion and contraction.
- F. Leveling of Column Base Plates: Contractor shall specify the means and methods for leveling the column base plates during erection. The leveling method shall have sufficient strength to support the imposed loads, including construction loading.
- G. Field Assembly:
1. Clean bearing surfaces and surfaces to be in permanent contact before assembling members.
  2. Do not fasten splices of columns and other members with bearing joints designated on the drawings before abutting surfaces have been brought completely into contact.
  3. Bolted Construction:
    - a. Installation of high-strength bolts shall conform to ASTM A325 for slip-critical or snug-tightened type joints, as applicable, in accordance with RCSC. Provide washer under head or nut of high strength bolts. Washer shall be provided under the element being turned during tightening. Bolts in welded connections shall be tensioned after completion of welding.
    - b. At bolted joints designated as Slip-Critical or that require pretension, use Twist-off-Type Tension-Control bolt assemblies or Direct Tension Indicators.
    - c. Do not use flame cutting to align bolt holes except as permitted by RCSC specifications. Ream holes that must be enlarged to admit bolts. Do not enlarge holes to a diameter greater than 1." When reaming beyond 1/32", drill or ream to the next larger hole size and use the next larger size bolt.
  4. Mill scale shall be removed from the column in the area where the beam flanges will be welded to the column.
- H. Gas Cutting: Use of flame cutting torch will be permitted only after the Architect's prior written approval and only where metal cut will not carry stress during cutting, and cut surfaces will not be visible. When thermal cutting is permitted, cutting shall be done with a mechanically guided torch or a torch controlled using a guide bar.

- I. Field Touch-Up Painting: After erection, touch-up paint field connections and abrasions resulting from the Work of this Section with same paint used for shop prime painting.
- J. Remove and repair galvanized surface as required for field welding in accordance with ASTM-A780, A2; required thickness is 100 micro-inches. Touch up with zinc-rich coating. Repair material shall extend at least three inches beyond edges of damaged areas.
- K. Protected Zone: Attachments to structural steel in the Protected Zone, other than spot welding of metal deck to beams, are not allowed

### 3.03 CLEANING

- A. After erection, thoroughly clean surfaces of foreign or deleterious matter such as dirt, mud, oil, or grease that would impair bonding of fireproofing, concrete, or other finishes as applicable.
- B. Architecturally Exposed Structural Steel (AESS).
  - 1. If temporary braces or erection clips are used, remove braces and clips in a manner which prevents unsightly surfaces.
  - 2. Tack welds shall be ground smooth.
  - 3. Holes shall be filled with weld filler metal or body solder and ground smooth.
  - 4. All operations shall be performed such that the close fit and neat appearance of the structure will not be impaired.

### 3.04 FIELD QUALITY ASSURANCE

- A. The Project Inspector will:
  - 1. Verify proper anchor rod group location, elevation, and orientation prior to placement of concrete foundations, and again subsequent to placement of concrete foundations prior to arrival of structural steel.
- B. The Owner's Testing Agency will:
  - 1. Perform field welding inspection and testing in accordance with the requirements in Part 2 of this Specification for shop fabrication, unless otherwise noted.
  - 2. Inspect and test high strength bolted joints in accordance with RCSC and CBC Sections 1704A.3.3.
  - 3. Sample and test bolt assemblies that include direct tension indicators, on a daily basis to verify proper indication of deformation with required bolt tension for each size and lot. The Inspector shall have a torque wrench, calibrated daily, to verify correlation with proper tension as installation proceeds. Test at least 10 percent of the bolts with a minimum of two per connection from the start of bolting and until waived by the DSA Field Engineer upon demonstration of continued good workmanship.
  - 4. Inspect erected structural steel as required to establish conformity of Work with reviewed shop drawings and Contract Drawings.
  - 5. Perform testing and inspection of welded stud connectors in accordance with requirements of AWS D1.1 and CBC Section 2212A.3, except that the test studs shall be subjected to a 90 degree bend test by striking them with a heavy hammer. After the bend test, the weld section shall not exhibit any tearing or cracking.
  - 6. Inspect structural steel to verify that the Protected Zones of members of the Seismic-Load-Resisting System are free of damage and attachments not approved by the Structural Engineer.
  - 7. Inspect braced frame connections prior to welding of braces to gusset plate to verify that the required clear width of gusset plate between the end of the brace and the diagonal stiffener plate, noted on the drawings as the "free plate zone", is maintained.
  - 8. Forward copies of all test and inspection reports to the Owner, Project Inspector, Architect, Structural

Cañada College  
Electrical Infrastructure Replacement Project  
San Mateo County Community College District

Bid No. 86624

Engineer, Contractor, and DSA.

**END OF SECTION**



**SECTION 05310**

**STEEL DECKING**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section Includes: Provision of steel decking as indicated in Contract Drawings with directly attached accessory items as noted and required for complete installation. Accessory items include but are not necessarily limited to the following:
  - 1. Closure strips.
- B. Related Sections:
  - 1. Section 03 30 00 - Cast-In-Place Concrete.
  - 2. Section 05 12 00 - Structural Steel.
  - 3. Section 05 50 00 - Metal Fabrications.

**1.02 REFERENCES**

- A. Requirements of GENERAL CONDITIONS and DIVISION NO. 1 apply to all Work in this Section.
- B. Published specifications, standards, tests or recommended methods of trade, industry or governmental organizations apply to Work of this Section where cited by abbreviations noted below (latest editions apply unless otherwise noted).
  - 1. California Code of Regulations, Title 24, Part 2, 2007 Edition, also known as California Building Code (CBC).
  - 2. American Society for Testing and Materials (ASTM).
  - 3. American Iron and Steel Institutes' "Specifications for the Design of Cold Formed Steel Structural Members" (AISI).
  - 4. Steel Decking Institutes' "Steel Roof Deck Design Manual" (SDI).
  - 5. American Welding Society's "Structural Welding Code-Sheet Steel" (AWS D1.3).

**1.03 QUALITY CONTROL**

- A. Welder's Qualifications:
  - 1. Welders shall be qualified for horizontal, vertical, and overhead positions in accordance with AWS D1.3.

**1.04 SUBMITTALS**

- A. Manufacturer's literature describing products.
- B. Samples: only as requested.
- C. Shop drawings:
  - 1. Show deck type, location, orientation and laps. Show type, location and sequence of welds. Show large scale details of connections, methods of attachment and accessory items.
  - 2. Prior to submission of structural steel erection plans, submit deck plans showing dimensioned locations of edge of deck and deck openings.
- D. Certificates:

1. Certify that materials meet requirements specified.
2. Submit certified mill reports of chemical and physical properties for each heat of steel proposed for use.

### **1.05 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Deliver, store and handle decking in manner to prevent damage or deformation.
- B. Discharge materials carefully, store on platform or pallets, and cover with tarpaulins or other suitable weathertight covering. Do not dump onto ground.
- C. Do not overload decking during construction period and do not use decking for storage or working platform prior to welding in position.

### **1.06 JOB CONDITIONS**

- A. Provide the Owner's Testing Agency with free access to places whether on or off the jobsite where materials are stored or fabricated, to places where equipment is stored or serviced, and to jobsite during times of installation.
- B. Sequencing, Scheduling: Notify the Architect in sufficient time prior to fabrication, field welding or installation to permit testing and inspection without delaying Work.

## **PART 2 - PRODUCTS**

### **2.01 STEEL DECKING TYPES**

- A. General Requirements:
  1. Steel decking shall be designed in accordance with SDI unless specifically noted otherwise.
  2. Section design properties shall be computed in accordance with applicable requirements of AISI.
  3. Steel decking shall be ICBO-approved for vertical loads and lateral shear resistance.
- B. Steel Decking:
  1. Typical by Verco Manufacturing Co. or equal product comply with ICC Report ER-2078P substituted per Section 01630.
  2. Accoustical Deck at Gymnasiums: By Epic Metals Co. complying with ICC-ES Report ER-3784.
  3. See Structural Drawings for gauge, configuration, section properties and attachments.
- C. Steel Deck diaphragm shall comply with CBC Section 2203A.1.

### **2.02 MATERIALS**

- A. Steel decking shall be identified per CBC Section 2203A.1.
- B. Sheet Steel: ASTM A653, Grade A (min.  $F_y = 38$  ksi), zinc galvanized coating in accordance with ASTM A653, Coating Designation G60.
- C. Miscellaneous Steel Shapes (angles and channels): ASTM A572, Grade 50.
- D. Touch-up Paint:
  1. For Abraded Galvanizing: Zinc oxide or zinc dust primer for galvanized metal.
- E. Welding Electrodes: Low-hydrogen electrodes in accordance with AWS D1.1 and D1.3.

### **2.03 FABRICATION**

- A. Preparation:
  - 1. Coordinate with other work supporting, contacting and adjoining metal decking and verify requirements for cutting out, fitting and attaching.
  - 2. Verify dimensions and locations at site whenever construction progress permits.
- B. General Requirements:
  - 1. Fabricate in accordance with SDI unless specifically noted otherwise.
  - 2. Shop- or field-cut units to fit around openings, along building perimeter and around columns.
  - 3. Provide in lengths to be continuous for not less than three spans where possible.
- C. Closure Strips: Provide for installation at ends, edges and around openings as required to prevent leakage of concrete.
- D. Vents: Provide venting at decks with insulating concrete and conventional concrete fills.

#### **2.04 FINISHES**

- A. Galvanizing: Where items have not been fabricated from galvanized steel sheet, hot-dip galvanize after fabrication in accordance with ASTM A153, A385, or A123 as applicable.

#### **2.05 SOURCE QUALITY CONTROL**

- A. The Owner's Testing Agency will:
  - 1. Review mill analysis and certificates of compliance.
  - 2. Test samples of unidentified steel as required by CBC Section 2203A.1.

### **PART 3 - EXECUTION**

#### **3.01 EXAMINATION**

- A. Examine construction to support decking and verify that:
  - 1. Dimensions are correct.
  - 2. Setting conditions are proper.
  - 3. Means of attachment integral with support is correct.
- B. Do not start installation until unsatisfactory conditions have been corrected.

#### **3.02 INSTALLATION**

- A. General Requirements:
  - 1. Install decking in accordance with Contract documents, ICBO Approval and Manufacturer's recommendations.
  - 2. Provide flashings, closure strips, closure plates, reinforcing and fastenings as required.
  - 3. Perform shaping, cutting, drilling and fitting in manner equal to workmanship of shop fabrication.
  - 4. Button-punching or crimping in lieu of welding or Verco Punch-Lok System, where specified, will not be permitted.
- B. Layout:
  - 1. Place and adjust units in final position prior to permanent fastening.

2. Install in straight, continuous rows with ribs at right angles to supporting members unless otherwise shown.
3. Align ribs to be straight within 1/4-inch in overall length of decking.
4. Locate butted ends tight at center line of structural support with positive, solid, complete bearing over full width of panel without deforming units. Insure not less than 2-inch bearing on support. Use lap splice of deck ends at top chords of steel joists, and stagger deck welds to both chord members.
5. Locate extreme ends and edges over structural supports with positive, solid complete bearing over full width of support for full width of length of panel without deforming units.

C. Welding Procedure:

1. Perform welding in accordance with AISI, AWS D1.3 and CBC Section 1704A.3.
2. Ensure surfaces to receive weld metal are clean and dry.
3. Weight units near welding points to secure firm contact of surfaces welded.
4. Surfaces with temperature below 32 degrees Fahrenheit: Preheat to minimum 70 degrees Fahrenheit and maintain during welding.
5. Maintain long arc while electrode is moved in circular direction until proper hole size is burned in sheet metal. Shorten arc and deposit weld metal around complete circumference of hole.
6. Clean all welds immediately by wire brushing and touch-up with paint before covering with succeeding panel.
7. Take special care to secure solid welds where unit is warped or curved or meets supporting member at angle.

D. Reinforcing:

1. Reinforce opening as shown on drawings.
2. Provide reinforcing wherever else structurally required.

E. Closure Strips: Attach to decking with tack welds.

F. Acoustical Inserts: Install in all flutes of acoustical deck per manufacturer's recommendations. Do not install prior to inspection of deck welding.

### 3.03 CLEANING AND PAINTING

A. Touch-up Painting:

1. Galvanized surfaces and field welds: Where galvanizing has been damaged in handling or burned off top or bottom surfaces in welding, repair in accordance with ASTM A780.
2. Prime-coated structural steel framing: Where welding metal decking to structural steel has burned off prime-coat or resulted in other damage, apply paint as required to restore coverage.

B. Prepare surfaces as necessary for proper application of structural concrete.

### 3.04 FIELD QUALITY CONTROL

A. The Owner's Testing Agency will:

1. Provide continuous inspection of welding, including prior fit-up, welding equipment, weld quality and welder certification per CBC Section 1704A.3.
2. Provide continuous inspection during installation as required to establish conformity of Work with requirements.

**END OF SECTION**



**SECTION 05 50 00**

**METAL FABRICATIONS**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section Includes
  - 1. Steel stairs with metal grating treads and landings.
  - 2. Painted, galvanized steel pipe guardrails, handrails, and railings.
  - 3. Steel tubular frame fences and gates with infill as indicated.
  - 4. Link chain at Building 30 driveway.
  - 5. Miscellaneous channels, angles and other shapes as required.
  - 6. Rough hardware.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- C. Related Sections
  - 1. Section 05 12 00 - Structural Steel: For welding inspection requirements.
  - 2. Section 07 62 00 - Sheet Metal Flashing and Trim: Provision of miscellaneous sheet metal flashing and trim.
  - 3. Section 08 71 00 - Door Hardware: Provision of hardware for gate.
  - 4. Section 09 90 00 - Painting and Coating: For priming galvanized metal fabrications and for finish painting of items not specified to have factory finish.
  - 5. Section 32 31 00 - Fences and Gates: Provision of chain link fabric fences and gates.

**1.02 REFERENCES**

- A. AISC - American Institute of Steel Construction
- B. ANSI - American National Standards Institute
  - 1. B18.6.3 - Machine Screws and Machine Screw Nuts.
  - 2. B18.21.1 - Lock Washers (Inch Series).
  - 3. B18.22.1 - Plain Washers.
- C. ASTM - American Society for Testing and Materials
  - 1. A27 - Standard Specification for Steel Castings, Carbon, for General Application.
  - 2. A36 - Standard Specification for Carbon Structural Steel.
  - 3. A47 - Standard Specification for Ferritic Malleable Iron Castings.
  - 4. A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
  - 5. A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - 6. A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
  - 7. A276 - Standard Specification for Stainless Steel Bars and Shapes.
  - 8. A283 - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
  - 9. A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
  - 10. A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
  - 11. A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.

12. A510 - Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel.
  13. A563 - Standard Specification for Carbon and Alloy Steel Nuts.
  14. A780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
  15. A786 - Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates.
  16. B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
  17. B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
  18. C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
  19. E488 - Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements.
  20. F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
  21. F594 - Standard Specification for Stainless Steel Nuts.
- D. AWS - American Welding Society
1. D1.1 - Structural Welding Code - Steel.
  2. D1.3 - Structural Welding Code - Sheet Steel.
- E. CBC - California Building Code, 2007 Edition
- F. NAAMM - National Association of Architectural Metal Manufacturers
1. MBG 531 - Metal Bar Grating Manual.
  2. MFM - Metal Finishes Manual for Architectural and Metal Products.
  3. MS - Metal Stair Manual.
- G. SSPC - The Society for Protective Coatings
1. PA 1 - Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel.
  2. SP 2 - Surface Preparation Specification No. 2: Hand Tool Cleaning.
  3. SP 3 - Surface Preparation Specification No. 3: Power Tool Cleaning.
  4. SP 6 - Surface Preparation Specification No. 6: Commercial Blast Cleaning.

### 1.03 SYSTEM DESCRIPTION

- A. Design Requirements
1. General
    - a. Support normally imposed loads in conformity with AISC requirements.
    - b. Provide for expansion and contraction.
    - c. Built-up parts shall exhibit no warp.
    - d. Exterior items shall exclude water.
    - e. Wind Load Requirements for Exterior Items: Members shall withstand dead and live loads caused by pressure and suction of wind in accordance with CBC.
  2. Treads, Landings, and Stringers
    - a. Conform to CBC.
    - b. Steel Treads: Capable of withstanding a uniform load of 100 lbf per sq. ft. or a concentrated load of 300 lbf on an area of 4 sq. inches located in the center of the tread, whichever produces the greater stress.
    - c. Steel Platforms: Capable of withstanding uniform load of 100 lbf per sq. ft.
    - d. Stringers shall be capable of withstanding uniform load set forth in CBC.
  3. Structural Performance of Handrails and Railing Systems: Fabricate and install handrails and railing systems to withstand structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections. Apply each load to produce the maximum stress in each of the respective components of each metal fabrication in accordance with CBC.

#### **1.04 SUBMITTALS**

- A. Product Data: Submit manufacturer's product data for paint products and grout.
- B. Shop Drawings: Submit shop drawings detailing fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other Sections.
- C. Samples: Submit samples representative of materials and finished products as may be requested by the Architect.
- D. Quality Control Submittals: Welder certificates signed by Contractor certifying that welders comply with requirements specified under the "Quality Control" Article.

#### **1.05 QUALITY CONTROL**

- A. Qualifications
  - 1. Fabricator: Firm experienced in producing metal fabrications similar to those indicated for this Project with a record of successful in-service performance, and with sufficient production capacity to produce required units without delaying the Work.
  - 2. Installer: Arrange for metal stair installation specified in this Section by the same firm that fabricated them.
- B. Welding Standards: Comply with applicable provisions of AWS D1.1 and AWS D1.3.
  - 1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
- C. Inspection Requirements: Welding inspections required for stair fabrication and field installation shall be in accordance with the requirements of Section 05 12 00.

#### **1.06 PROJECT CONDITIONS**

- A. Field Measurements
  - 1. Check actual locations of walls and other construction to which metal fabrications must fit by accurate field measurements before fabrication. Show recorded measurements on final shop drawings.
  - 2. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
    - a. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabricating products without field measurements. Coordinate construction to ensure that actual dimensions correspond to guaranteed dimensions. Allow for trimming and fitting.

### **PART 2 - PRODUCTS**

#### **2.01 MATERIALS**

- A. Metal Surfaces, General: For metal fabrications exposed to view in the completed Work, provide materials selected for their surface flatness, smoothness, and freedom from surface blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names or roughness.
  - 1. All exterior metalwork shall be galvanized.

- B. Steel and Iron
  - 1. Steel Plates, Shapes and Bars: ASTM A36.
  - 2. Stainless Steel Shapes: ASTM A276.
  - 3. Cold-Formed Steel Tubing: ASTM A500.
    - a. For exterior installations and where indicated, provide tubing with hot-dip galvanized coating per ASTM A123.
  - 4. Hot-Formed Steel Tubing: ASTM A501.
    - a. Where indicated, provide tubing with hot-dip galvanized coating per ASTM A53.
  - 5. Steel Pipe: ASTM A53, Type S, Grade B, Schedule 40, unless otherwise indicated, or another weight required by structural loads.
    - a. Galvanized finish except as otherwise indicated.
  - 6. Rolled-Steel Floor Plate: ASTM A786, rolled from plate complying with ASTM A36 or ASTM A283, Grade C or D.
  - 7. Steel Bar for Grating Treads and Platforms: ASTM A36.
  - 8. Wire Rod for Grating Crossbars: ASTM A510.
  - 9. Concrete Inserts: Anchors of type indicated below, fabricated from corrosion resistant materials capable of sustaining, without failure, the load imposed within a safety factor of 4, as determined by testing per ASTM E488, conducted by a qualified independent testing agency.
    - a. Threaded or wedge type; galvanized ferrous castings, either ASTM A47 malleable iron or ASTM A27 cast steel. Provide bolts, washers, and shims as required, hot-dip galvanized in accordance with ASTM A153.
- C. Aluminum Extrusions: ASTM B221, alloy 6063-T6.
- D. Fasteners: Provide plated fasteners complying with ASTM B633, Class Fe/Zn 25 for electrodeposited zinc coating, for exterior use or where built into exterior walls. Select fasteners for the type, grade, and class required.
  - 1. Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A, with hex nuts, ASTM A563, and, where indicated, flat washers.
  - 2. Machine Screws: ANSI B18.6.3.
  - 3. Plain Washers: Round, carbon steel, ANSI B18.22.1.
  - 4. Lock Washers: Helical, spring type, carbon steel, ANSI B18.21.1.
  - 5. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E488 conducted by a qualified independent testing agency.
    - a. Material: Carbon steel components zinc-plated to comply with ASTM B633, Class Fe/Zn 5.
    - b. Material: Group 1 alloy 304 or 316 stainless steel bolts and nuts complying with ASTM F593 and ASTM F594.
- E. Welding Materials: AWS D1.1, type required for materials being welded.
- F. Handrail Brackets: Steel, as indicated on the Drawings.
- G. Gate Hardware: Refer to Section 08 71 00 for additional requirements.
  - 1. Provide extra heavy duty weldable hinges.
  - 2. Provide blocking, plates, and accessories as required to support and reinforce for hardware.
  - 3. Weld cane bolt to gate frame and set strike for positive engagement.
  - 4. Adjust hardware and gates for proper operation and clearances.
- H. Coatings
  - 1. Coatings for Protection of Dissimilar Materials
    - a. Dissimilar Metals: Bituminous type materials conforming with MIL Standard 889.
    - b. Aluminum in Contact with Concrete, Metal, Wood or other Absorptive Material.

2. Shop Primer for Ferrous Metal: VOC compliant, fast-curing, lead and chromate free, universal modified alkyd primer with good resistance to corrosion, compatible with finish paint systems.
  3. Galvanizing Repair Paint: High zinc dust content paint, with dry film containing not less than 94 percent zinc dust by weight
    - a. Product: Parker Amchem, "Galvaprep SG"; Sherwin Williams, "Zinc Clad I"; Alvin Products, Inc., "Galvax"; ZRC Chemical Products Co., "ZRC Cold Galvanizing Compound", or equal.
- I. Nonshrink, Nonmetallic Grout
1. Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
  2. Manufacturer: Five Star Products, "Five Star Grout"; Master Builders Technologies, Inc., "Masterflow 928 and 713"; W. R. Meadows, Inc., "Sealtight 588 Grout", or equal.
- J. Link Chain at Building 30 Driveway: Provide heavy weight link chain compatible with 7/16-inch diameter padlock hasp.

## **2.02 FABRICATION, GENERAL**

- A. Form metal fabrications from materials of size, thickness, and shapes indicated but not less than that needed to comply with performance requirements indicated. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of each metal fabrication.
- B. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.
- C. Allow for thermal movement resulting from the following maximum change (range) in ambient temperature in the fabrication and installation of installed metal assemblies to prevent buckling, opening up of joints, and overstressing of welds and fasteners. Base design calculations on actual surface temperatures of metals due to both solar heat gain and nighttime sky heat loss.
1. Temperature Change (Range): 100 degrees Fahrenheit.
- D. Shear and punch metals cleanly and accurately. Remove burrs.
- E. Ease exposed edges to a radius of approximately 1/32-inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- F. Remove sharp or rough areas on exposed traffic surfaces.
- G. Weld corners and seams continuously to comply 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. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing, and contour of welded surface matches those adjacent.
- H. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

- J. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- K. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- L. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.
- M. Tubular Fences and Gates: As indicated on the Drawings. Refer to Section 08 71 00 for additional requirements for hardware.

### **2.03 METAL STAIRS**

- A. General: Construct stairs to conform to sizes and arrangements indicated. Join pieces together by welding, unless otherwise indicated. Provide complete stair assemblies, including metal framing, hangers, columns, handrails, railing systems, newels, balusters, struts, clips, brackets, bearing plates, or other components necessary for the support of stairs and platforms, and as required to anchor and contain the stairs on the supporting structure.
  - 1. NAAMM Stair Standard: Comply with “Recommended Voluntary Minimum Standards for Fixed Metal Stairs” in NAAMM MS for Commercial class of stair designated, except where more stringent requirements are indicated.
- B. Stair Framing: Fabricate stringers of structural metal channels, plates, or a combination thereof, as indicated. Provide closures for exposed ends of stringers. Construct platforms of structural steel channel headers and miscellaneous framing members as indicated. Weld headers to stringers and weld newels and framing members to stringers and headers.
- C. Metal Bar Grating Stairs: Form treads and platforms to configurations shown from metal bar grating; fabricate to comply with NAAMM MBG 531.
  - 1. Provide treads and platforms as indicated fabricated from welded or pressure-locked steel bar grating, supported by steel angles. Limit openings in gratings to no more than 1/2-inch in least dimension.
  - 2. Surface: Plain.
  - 3. Finish: Galvanized with shop primer.
  - 4. Fabricate grating treads with rolled-steel floor plate nosing and with steel angle or steel plate carrier at each end for stringer connections. Secure treads to stringers with bolts.
  - 5. Fabricate grating platforms with nosing matching that on grating treads. Provide toeplates at open-sided edges of grating platforms. Weld grating to platform framing.

### **2.04 GUARDRAILS, HANDRAILS, AND RAILINGS**

- A. General: Fabricate guardrails, handrails and railing systems to comply with requirements indicated for design, dimensions, details, finish and member sizes, including thickness of handrails and posts, post spacings, and anchorage, but not less than that required to support loads.
- B. Interconnect railing and handrail members by butt-welding or welding with internal connectors, at fabricator’s option, unless otherwise indicated.
- C. Form changes in direction of handrails and rails as detailed.
- D. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated.

- E. Brackets, Flanges, Fittings and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors for interconnections of metal work and attachment of handrails and railing systems to other work. Furnish inserts and other anchorage devices for connecting handrails and railing systems to concrete or masonry work.
- F. Fillers: Provide steel or aluminum sheet or plate fillers of thickness and size indicated or required to support structural loads of handrails where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses. Size fillers to produce adequate bearing to prevent bracket rotation and overstressing of substrate.
- G. For galvanized handrails and railing systems, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

## **2.05 MISCELLANEOUS FRAMING AND SUPPORTS**

- A. General: Provide steel framing and supports for applications indicated that are not a part of structural steel framework as required to complete the Work.
- B. Fabricate units to sizes, shapes, and profiles indicated and required to receive other adjacent construction retained by framing and supports. Fabricate from structural steel shapes, plates, and steel bars of welded construction using mitered joints for field connection. Cut, drill, and tap units to receive hardware, hangers, and similar items.
  - 1. Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units must be installed after concrete is placed.
    - a. Except as otherwise indicated, space anchors 24 inches on center and provide minimum anchor units in the form of steel straps 1-1/4 inches wide by 1/4-inch thick by 8 inches long.
- C. Galvanize miscellaneous interior and exterior framing and supports.

## **2.06 FINISHES, GENERAL**

- A. Comply with NAAMM MFM for recommendations relative to applying and designing finishes. Finish metal fabrications after assembly.

## **2.07 STEEL AND IRON FINISHES**

- A. Galvanizing
  - 1. For those items indicated for galvanizing, apply zinc coating by the hot-dip process complying with the following requirements:
    - a. ASTM A153 for galvanizing iron and steel hardware.
    - b. ASTM A123 for galvanizing both fabricated and unfabricated iron and steel products made of uncoated rolled, pressed, and forged shapes, plates, bars, and strip 0.0299-inch thick or thicker.
  - 2. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Preparation for Shop Priming: Prepare uncoated ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
  - 1. Typical: SSPC SP 2, SSPC SP 3 as required.
  - 2. Architectural Exposed Steel Fabrications: SSPC SP 6.
- C. Apply shop primer to metal fabrications, except those to be embedded in concrete, unless otherwise indicated. Comply with requirements of SSPC PA 1 for shop painting.

- D. Aluminum: Mill finish or clear anodized finish, unless otherwise specified.
- E. Priming Galvanized Metals: As specified in Section 09 90 00.
- F. Finish Painting: As specified in Section 09 90 00.

### **PART 3 - EXECUTION**

#### **3.01 PREPARATION**

- A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installing anchorages, including concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.
- B. Set sleeves in concrete with tops flush with finish surface elevations. Protect sleeves from water and concrete entry.

#### **3.02 INSTALLATION, GENERAL**

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, screws, and other connectors as required.
- B. Cutting, Fitting and Placement: Perform cutting, drilling, and fitting required for installing miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment and elevation; with edges and surfaces level, plumb, true and free of rack; and measured from established lines and levels.
- C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete masonry or similar construction.
- D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop-welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units that have been hot-dip galvanized after fabrication and are intended for bolted or screwed field connections.
- E. Field Welding: Comply with the following requirements:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing, and contour of welded surface matches those adjacent.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.
- G. Tubular Fences and Gates: As indicated on the Drawings. Refer to Section 08 71 00 for additional requirements for hardware.



**3.03 INSTALLING GUARDRAILS, RAILINGS AND HANDRAILS**

- A. Adjust guardrails, handrails and railing systems prior to anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loadings. Plumb posts in each direction. Secure posts and railing ends to building construction as follows:
  - 1. Anchor posts to steel by welding directly to steel supporting members.
  - 2. Anchor handrail ends into concrete and masonry with steel round flanges welded to rail ends and anchored into wall construction with drilled-in expansion anchors.
  
- B. Secure handrails to wall with wall brackets and end fittings of the same material and finish. Provide bracket with 1-1/2 inch clearance from inside face of handrail and finished wall surface of the same material and finish, unless otherwise noted. Locate brackets at spacing required to support structural loads. Secure wall brackets and wall return fittings to building construction as follows:
  - 1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.

**3.04 ADJUSTING AND CLEANING**

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC PA 1 requirements for touching up shop-painted surfaces.
  - 1. Apply by brush or spray to provide a 2.0-mil minimum dry film thickness.
  
- B. For galvanized surfaces, clean welds, bolted connections and abraded areas, and apply galvanizing repair paint to comply with ASTM A780.

**END OF SECTION**

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**SECTION 06 10 00**

**ROUGH CARPENTRY**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section Includes
  - 1. Composite wood fence boards.
  - 2. Plywood backing panels for mounting electrical and telephone equipment.
  - 3. Miscellaneous blocking and nailers.
  - 4. Rough hardware.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- C. Related Section
  - 1. Section 09 90 00 - Painting and Coating: For finish painting.

**1.02 REFERENCES**

- A. AISI - American Iron and Steel Institute
- B. ANSI - American National Standards Institute
  - 1. B18.2.1 - Square and Hex Bolts and Screws.
  - 2. B18.6.1 - Wood Screws (Inch Series).
- C. APA - American Plywood Association
  - 1. Guide to Plywood Grades.
- D. ASTM - American Society for Testing and Materials
  - 1. A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
  - 2. A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
  - 3. A563 - Standard Specification for Carbon and Alloy Steel Nuts.
  - 4. D3201 - Standard Test Method for Hygroscopic Properties of Fire-Retardant Wood and Wood-Base Products.
- E. AWPA - American Wood Preservers' Association
  - 1. C2 - Lumber, Timbers, Bridge Ties and Mine Ties - Preservative Treatment by Pressure Processes.
  - 2. C9 - Plywood-Preservative Treatment by Pressure Processes.
  - 3. C20 - Structural Lumber - Fire Retardant Treatment by Pressure Processes.
  - 4. C27 - Plywood - Fire-Retardant - Pressure Treatment.
  - 5. M4 - Standard for the Care of Preservative-Treated Wood Products.
- F. FS - Federal Specifications
  - 1. FF-N-105 - Nails, Brads, Staples and Spikes: Wire, Cut and Wrought.
- G. USPS - United States Product Standard
  - 1. PS1 - Construction and Industrial Plywood.
- H. UL - Underwriters Laboratories, Inc.
  - 1. BMD - Building Materials Directory

- I. WCLIB - West Coast Lumber Inspection Bureau

**1.03 QUALITY ASSURANCE**

- A. Plywood shall bear grade-trademarks of appropriate grading agency.

**PART 2 - PRODUCTS**

**2.01 COMPOSITE WOOD**

- A. Fence Boards
1. Composition: Reclaimed wood and plastic with integral coloring; free from toxic chemicals and preservatives.
  2. Dimensions: 1 inch thick by nominal 6 inches wide; length as required.
  3. Edge Treatment: Square.
  4. Texture: Match existing fencing at Building 7.
  5. Color: Weathered grey to match existing fencing at Building 7.
  6. Product: As manufactured by Plastic Lumber Yard, "Foreverdeck", or equal.

**2.02 PLYWOOD**

- A. Plywood Panels: APA A-A, USPS PS1, Exposure 1, 3/4-inch thickness.
- B. Fire Treatment at Electrical and Telephone Rooms: Panel Source International, "PyroBlock Plus MDF" and "PyroBlock Plus Particleboard". No known equal.

**2.03 MISCELLANEOUS LUMBER**

- A. General: Provide lumber for support or attachment of other construction including rooftop equipment curbs and support bases, cant strips, bucks, nailers, blocking, furring, battens, stripping and similar members.
- B. Fabricate miscellaneous lumber from dimension lumber of sizes indicated and into shapes shown.
- C. Moisture Content: 19 percent maximum for lumber items not specified to receive wood preservative treatment.
- D. Pressure Treated: Provide pressure-treated lumber for wood nailers associated with metal roofing system, as specified in Section 07 61 00.
- E. Grade: "Standard" grade, light framing size lumber of any species or board-size lumber as required. "No. 3 Common" or "Standard" grade boards per WCLIB rules.

**2.04 ROUGH HARDWARE**

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
1. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with a hot-dip zinc coating per ASTM A153 or of AISI Type 304 stainless steel.
- B. Nails, Wire, Brads, and Staples: FS FF-N-105.
- C. Wood Screws: ANSI B18.6.1.

- D. Lag Bolts and Screws: ANSI B18.2.1.
- E. Bolts: Steel bolts complying with ASTM A307, Grade A; with ASTM A563 hex nuts and where indicated, flat washers.
- F. Fasteners for Fence Boards: #10 stainless steel pan head screws.

## **2.05 FINISHES**

- A. Finish Painting: As specified in Section 09 90 00.

## **PART 3 - EXECUTION**

### **3.01 PRESERVATIVE WOOD TREATMENT BY PRESSURE PROCESS**

- A. General: Where lumber or plywood is indicated as preservative-treated wood or is specified herein to be treated, comply with applicable requirements of AWPA C2 and C9. Mark each treated item with the AWPB Quality Mark Requirements.
  - 1. Wood preservative chemicals shall be free of arsenic. Non-arsenic treated wood includes ACQ, CBA, or borate-treated wood.
- B. Pressure-treat above ground items with water-borne preservatives to a minimum retention of 0.40 lb./cu. ft. For interior uses, after treatment, kiln-dry lumber and plywood to a maximum moisture content, respectively, of 19 percent and 15 percent. Treat indicated items and the following:
  - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers and waterproofing.
  - 2. Wood blocking and similar concealed members in contact with concrete.
- C. Complete fabrication of treated items prior to treatment, where possible. If cut after treatment, coat cut surfaces to comply with AWPA M4. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.

### **3.02 FIRE RETARDANT TREATMENT BY PRESSURE PROCESS**

- A. General: Where fire retardant treated lumber and plywood is indicated, pressure impregnate lumber and plywood with fire retardant chemicals to comply with AWPA C20 and C27, respectively, for treatment type indicated; identify "fire retardant treated wood" with appropriate classification marking of UL BMD listed "FR-S" with same moisture content as untreated wood in tests conducted in accordance with ASTM D3201 at relative humidity up to 95 percent.
  - 1. Fire retardant chemicals used shall be free of halogens, sulfates, ammonium phosphate, and urea formaldehyde.
  - 2. Current Evaluation/Research Reports: Provide fire retardant treated wood for which a current model code evaluation/research report exists that is acceptable to authorities having jurisdiction and that evidences compliance of fire retardant treated wood for application indicated.
- B. Interior Type: For interior locations use fire retardant chemical formulation that produces treated lumber and plywood with the following properties under conditions present after installation:
  - 1. No reduction takes place in bending strength, stiffness, and fastener holding capacities below values published by manufacturer of chemical formulation that are based on tests by a qualified independent testing laboratory of treated wood products identical to those indicated for this Project under elevated temperature and humidity conditions simulating installed conditions.
  - 2. No other form of degradation occurs due to acid hydrolysis or other causes related to manufacture and treatment.
  - 3. No corrosion of metal fasteners results from their contact with treated wood.

- C. Inspect each piece of treated lumber or plywood after drying and discard damaged or defective pieces.

### **3.03 INSTALLATION**

- A. Composite Wood Fence Boards: As indicated on the Drawings.
  - 1. Secure boards with a minimum of 2 fasteners to each support. Pre-drill all fasteners.
- B. Plywood Panels
  - 1. Secure panels bearing firmly on supports.
  - 2. Provide 1/8-inch space at panel edge and end joints.
- C. Wood Nailers and Blocking
  - 1. Install wood battens, nailers and blocking where shown and where required for attachment of other work. Form to shapes as shown and cut as required for true line and level of work to be attached. Coordinate location with other work involved.
  - 2. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise indicated. Where possible, anchor to formwork before concrete placement.

**END OF SECTION**

**SECTION 07 13 26**

**SELF-ADHERING SHEET WATERPROOFING**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section Includes: For installation at retaining walls, below-grade building walls, and other locations as indicated.
  - 1. Modified bituminous sheet waterproofing, fabric reinforced, at vertical cast-in-place concrete and masonry.
  - 2. Geocomposite combined drainage and protection layer.
  - 3. Perforated drainage pipe.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- C. Related Sections
  - 1. Section 03 13 13 - Hydrophilic Rubber Waterstops: For sealant at pipe penetrations where indicated.
  - 2. Section 03 30 00 - Cast-in-Place Concrete: For vertical cast-in-place concrete.
  - 3. Section 33 40 00 - Storm Drainage: For storm drainage requirements.

**1.02 SUBMITTALS**

- A. Product Data: Submit product data for materials and accessories.
- B. Submit the following Informational Submittals:
  - 1. Certifications specified in Quality Assurance article.
  - 2. Qualification Data: Applicator's qualification data.
  - 3. Manufacturer's instructions; include applicable temperature ranges.
  - 4. Manufacturer's Field Reports: Written results and findings of manufacturer's field services specified as part of Field Quality Control.
- C. Closeout Submittals: Submit specified warranty.

**1.03 QUALITY ASSURANCE**

- A. Manufacturer's Qualifications
  - 1. Not less than 5 years documented experience in manufacturing of specified waterproofing.
  - 2. Obtain primary waterproofing materials from single manufacturer. Manufacturer's name shall appear on containers.
  - 3. Provide secondary materials as required by manufacturer of primary materials.
  - 4. Manufacturer's qualified technical representative will be required to visit Project site to advise applicator of procedures and precautions for installation of waterproofing materials.
  - 5. Manufacturer's technical representative will be required to be at Project site weekly during installation and immediately prior to installation of protection board to ensure waterproofing has been properly installed and warranty requirements have been met.
- B. Applicator Qualifications
  - 1. Acceptable to membrane manufacturer prior to execution of this Contract.
  - 2. Company specializing in application of specified waterproofing.
  - 3. Minimum 3 years documented experience with submitted product.

- C. District reserves the right to hire independent waterproofing consultant to review submittals, procedures, and installation.
- D. Certifications
  - 1. Submit manufacturer's certification stating materials ordered and supplied are compatible with each other, suited for locale and purpose intended, and shipped in sufficient quantity to ensure proper timely installation.
  - 2. Certification shall also state that waterproofing materials have express warranty of fitness for the particular purposes of this Project.
  - 3. Certify materials shipped to Project site meet membrane manufacturer's published performance standards and requirements of this Specification.

#### **1.04 PRE-INSTALLATION CONFERENCE**

- A. Agenda
  - 1. Review Project Specifications and Drawings.
  - 2. Establish installation schedules and sequence.
  - 3. Coordinate work with in-place and subsequent construction.
  - 4. Review weather and working conditions.
  - 5. Review installation procedures, including:
    - a. Substrate requirements for Project acceptance (curing of concrete surface, form release agents, temperature).
    - b. Waterproofing installation.
    - c. Phasing and sequencing requirements.
    - d. Termination, flashing, expansion joint, and penetration requirements.
    - e. Review inspection, testing, and quality control procedures.
    - f. Review protection requirements for construction period beyond waterproofing installation.
- B. Conduct tour of areas to be waterproofed and report on surface acceptance, possible problem areas, and recommended remedies.

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Do not double stack membrane pallets.
- B. Keep primer, mastics and adhesives in dry area away from flames, sparks and excessive heat.
- C. Store material in dry area out of direct sunlight.
- D. Cover materials and allow for adequate ventilation.

#### **1.06 PROJECT CONDITIONS**

- A. Environmental Requirements
  - 1. Do not apply products when surface or ambient temperature is below 40 degrees Fahrenheit unless special low temperature products are used.
  - 2. Do not apply products in any instances where surface temperature is lower than 25 degrees Fahrenheit.
  - 3. Do not apply to damp or frozen surfaces or during inclement weather.
- B. Do not work or walk on exposed waterproofing membrane. Install permanent protection board immediately to protect membrane during subsequent work operations.



### **1.07 SEQUENCING**

- A. Coordinate and sequence work to ensure that construction materials placed against or over waterproofing and protection system will occur within 7 days of membrane installation. Do not expose membrane to ultraviolet rays beyond period of time recommended by system manufacturer.
- B. Install protection board within 24 hours of membrane installation.

### **1.08 WARRANTY**

- A. Provide custom warranty or standard warranty with attachments for full replacement value of completed installation signed by manufacturer, applicator and Contractor warranting against water infiltration and defects of materials and workmanship for period of 2 years from date of Substantial Completion. If manufacturer will not allow installer and Contractor to sign manufacturer's warranty, append installer and Contractor's warranty to manufacturer's warranty to create warranty that covers labor and workmanship, including labor for access to waterproofing, for watertight warranty.
- B. Warranty penetrations, terminations, sealants, expansion joints, membrane, and protection board.
- C. Warranty shall include removing and reinstalling superimposed work covering waterproofing.
- D. Warranty with disclaimer disallowing implied warranties of merchantability and/or fitness for a particular purpose or other disclaimers that reduce District protection is not acceptable. If manufacturer's standard warranty is used and the warranty disclaims implied or expressed warranties of merchantability and fitness, the manufacturer shall remove that disclaimer and have authorized representative initial noting acceptance of warranty responsibility.

## **PART 2 - PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Acceptable Manufacturers: Grace Construction Products, "Bituthene 4000 Waterproofing System"; W. R. Meadows, Inc., "MEL-ROL or MEL-GARD"; MiraDri Moisture Protection, "Miradri 860"; Polyguard Products, Inc., "Polyguard No. 650 Membrane", or equal.

### **2.02 MODIFIED BITUMINOUS SHEET WATERPROOFING**

- A. Modified Bituminous Sheet: 60-mils thick, self-adhering sheet consisting of 56 mils of rubberized asphalt laminated to a 4-mil thick, polyethylene film with release liner on adhesive side and formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction.
- B. Primer/Conditioner: Water-based VOC compliant type required by membrane manufacturer. No solvent or 1,1,1-Trichloroethane based primers will be accepted.
- C. Mastic: Rubberized asphaltic type required by membrane manufacturer.
- D. Liquid Membrane: 2-component elastomeric, mastic grade as furnished by membrane manufacturer.
- E. Cement Mortar: Epoxy or latex modified cementitious composition acceptable to membrane manufacturer.
- F. Concrete Patching Compound: Fast setting, non-shrinking patching compound, of type acceptable to membrane manufacturer.

- G. Geocomposite Combined Drainage and Protection Layer: Preformed 0.375-inch thick geocomposite drainage sheet system comprised of a hollow studded polystyrene core, covered on one side with a non-woven, needle punched polypropylene filter fabric and on the other side with a smooth polymeric sheet.
  - 1. Product: As manufactured by Grace Construction Products, "Hydroduct 220", or equal.
- H. Tape: 2-sided, self-adhesive tape for adhering drainage composite sheets to waterproof membrane, as manufactured by Grace Construction Products, "Hydroduct Tape", or equal.

### **2.03 SEALANT**

- A. Install closed cell backer rod and 2-part polyurethane sealant around entire perimeter of gap.
  - 1. Backer Rod: Closed cell foam.
  - 2. Polyurethane Sealant: 2-part intended for below-grade applications.
  - 3. Silicone Sealant: As manufactured by Dow, "795", or equal.
  - 4. Expansion Joint Filler: Expandable custom fabricated profile, custom sized width to properly fit into the gap, as manufactured by Emseal, "DSM-DS System", or equal.

### **2.04 FLASHINGS, TERMINATIONS, AND ACCESSORIES**

- A. Termination Bar: Standard stainless steel termination bar recommended by waterproofing system manufacturer.
- B. Counterflashing: 24 gauge stainless steel reglet counterflashing.
- C. Pipe Band Clamps: Stainless steel.

## **PART 3 - EXECUTION**

### **3.01 EXAMINATION**

- A. Examine conditions and proceed with work when substrates are ready.
- B. Ensure surfaces are reasonably smooth and free of holes, cracks, or projections which might be detrimental to successful installation.
- C. Verify that curing methods used for concrete are compatible with membrane system.
- D. Verify that horizontal surfaces have smooth wood float finish, free from defects. Broom finish not acceptable.
- E. Verify that items penetrating waterproofing system are securely installed.
- F. Verify that concrete surfaces have cured a period of time acceptable to membrane manufacturer.

### **3.02 PREPARATION**

- A. Protect adjacent surfaces not designated to receive waterproofing.
- B. Clean and prepare surfaces in accordance with manufacturer's instructions.
- C. Seal cracks and joints in accordance with manufacturer's instructions. Use proper depth-width ratio required by sealant manufacturer.

- D. Remove sharp projections, fins, and loose material. Remove form ties to 3/4-inch minimum behind face of wall. Fill holes, voids, and honeycomb areas flush with concrete patching compound or cement mortar.
- E. Seal penetrations with mastic.
- F. Provide fillet or cant at junction of vertical and horizontal surfaces using cast-in-place cement mortar in configuration acceptable to membrane manufacturer.
- G. At existing below-grade walls, tie into existing waterproofing system. Install target patch. Clean and prep all surfaces free of dust, dirt, and debris. Grind existing concrete surfaces to properly prepare the surface to receive new waterproofing membrane. Apply primer on concrete surfaces. Install membrane and seal all laps with liquid membrane. Extend target patch minimum 12 inches onto existing membrane.

### **3.03 INSTALLATION OF MEMBRANE**

- A. Install in accordance with manufacturer's instructions and approved shop drawings.
- B. Apply primer/conditioner at rate required by manufacturer. Install only as much primer/conditioner as can be covered in same day.
- C. Prior to placing full membrane, provide membrane strips at inside corners, outside corners, and working joints. Center strips along axis of corner and joint.
- D. Extend membrane over footing and down face 6 inches minimum, except terminate at point 12 inches below floor slab of protected space where footings are at greater depth.
- E. Install membrane in shingle fashion with edges and ends overlapped at dimensions required by manufacturer. All laps and seams of sheet membrane to be sealed with liquid membrane.
  - 1. Provide 2 layers of membrane at concrete masonry walls below grade.
- F. Remove release paper layer. Roll out laps and surface with mechanical roller to encourage full contact bond.
- G. Completely bond membrane to substrate, except those areas directly over or within 3 inches of working cracks or expansion joints.
- H. Place uniform bead of mastic to joint edges at locations required by manufacturer.
- I. Seal perimeter ends and edges to adjoining surfaces.
- J. Seal items penetrating membrane with flashing membrane material and liquid membrane. Ensure positive seal with membrane and penetrating member.
  - 1. Secure membrane to conduits penetrating membrane with stainless steel pipe clamps and coat with liquid membrane.

### **3.04 INSTALLATION OF DRAINAGE COMPOSITES**

- A. Geocomposite Combined Drainage and Protection Layer: Install directly to bituthene waterproofing membrane in accordance with manufacturer's written instructions.

**3.05 FLASHINGS AND TERMINATIONS**

- A. Secure top edge of membrane with stainless steel termination bar secured 6 inches on center maximum with stainless steel fasteners. Coat termination bar with liquid membrane.
- B. Install 24 gauge stainless steel reglet counterflashing. Seal all fastener heads. Seal exposed top edge of reglet counterflashing with silicone sealant. Use primer on all surfaces. Flashing shall extend 8 inches minimum below-grade, unless otherwise indicated.

**3.06 FIELD QUALITY CONTROL**

- A. Manufacturer's Field Services
  - 1. Notify manufacturer prior to start of Work and make arrangements for manufacturer's technical representative to be present during first day's work to verify work is being conducted in accordance with their requirements.
  - 2. Submit summary report; include Project site observations, instructions and monitoring activities.

**3.07 CLEANING**

- A. Protect adjacent surfaces from damages and stains. Clean materials from surfaces where inadvertently applied.

**END OF SECTION**

**SECTION 07 19 00**

**WATER REPELLENTS**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section Includes: Clear water repellent coating.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- C. Related Section
  - 1. Section 09 90 00 - Painting and Coating: For finish painting.

**1.02 REFERENCES**

- A. ASTM - American Society for Testing and Materials
  - 1. E96 - Test Methods for Water Vapor Transmission of Materials.

**1.03 SYSTEM DESCRIPTION**

- A. Provide water repellents with the following properties based on testing manufacturer's standard products, according to test methods indicated, applied to substrates simulating Project conditions using same materials and application methods to be used for Project.
  - 1. Absorption: Minimum 90 percent reduction of absorption after 24 hours in comparison of treated and untreated specimens.
  - 2. Water-Vapor Transmission: Maximum 10 percent reduction in rate of vapor transmission in comparison of treated and untreated specimens, per ASTM E96.

**1.04 SUBMITTALS**

- A. Product Data: Submit manufacturer's product data including manufacturer's specifications, surface preparation and application instructions, recommendations for water repellents for each surface specified and protection and cleaning instructions. Include data substantiating that materials are recommended by manufacturer for applications indicated and comply with requirements.
- B. Samples: Submit 3, 12 inch by 12 inch samples on concrete masonry unit surfaces.
- C. Quality Control Submittals
  - 1. Test Reports: Submit material test reports from qualified independent testing agency indicating and interpreting test results relative to compliance of water repellents with Performance Requirements specified in the "Quality Assurance" article.
  - 2. Certificates: Submit certification by water repellent manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOC).

**1.05 QUALITY ASSURANCE**

- A. Regulatory Requirements: Comply with applicable rules of the pollution-control regulatory agency having jurisdiction in the Project locale regarding volatile organic compounds (VOC) and use of hydrocarbon solvents.

## **1.06 PROJECT CONDITIONS**

- A. Weather and Substrate Conditions: Do not proceed with application of water repellent (except with written recommendation of manufacturer) under any of the following conditions:
  - 1. Ambient temperature is less than 40 degrees Fahrenheit and greater than 95 degrees Fahrenheit.
  - 2. Substrate surfaces have cured for less than 1 month.
  - 3. Rain or temperatures below 40 degrees Fahrenheit are predicted for a period of 24 hours.
  - 4. Earlier than 24 hours after surfaces became wet.
  - 5. Substrate is frozen or surface temperature is less than 40 degrees Fahrenheit.
  - 6. Windy condition such that repellent may be blown to vegetation or substrates not intended.

## **PART 2 - PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Acceptable Manufacturer: Prosoco, Inc., "Hydrozo"; Evonik Degussa Corporation, "Protectosil Chem-Trete PB100 Water Repellent", or equal.

### **2.02 WATER REPELLENTS**

- A. Silanes: Penetrating water repellent. A monomeric compound containing approximately 40 percent alkyltrialkoxysilanes with alcohol, mineral spirits, water or other proprietary solvent carrier.

## **PART 3 - EXECUTION**

### **3.01 PREPARATION**

- A. Clean substrate of substances that might interfere with penetration or performance of water repellents. Test for moisture content, according to repellent manufacturer's written instructions, to ensure surface is sufficiently dry.
- B. Test for pH level, according to water repellent manufacturer's written instructions, to ensure chemical bond to silicate minerals.
- C. Protect adjoining work, including sealant bond surfaces, from spillage or blow-over of water repellent. Cover adjoining and nearby surfaces of aluminum and glass if there is the possibility of water repellent being deposited on surfaces. Cover live plants and grass. Immediately clean water repellent from adjoining surfaces, complying with manufacturer's cleaning recommendations.
- D. Coordination with Sealants: Do not apply water repellent until sealants for joints adjacent to surfaces receiving water repellent treatment have been installed and cured.
  - 1. Water repellent work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those used in the work.

### **3.02 APPLICATION**

- A. Apply a heavy saturation spray coating of water repellent on surfaces indicated for treatment using low-pressure spray equipment. Comply with manufacturer's written instructions for using airless spraying procedure, unless otherwise indicated.

- B. Apply a second saturation spray coating, repeating first application. Comply with manufacturer's written instructions for limitations on drying time between coats and after rainstorm wetting of surfaces between coats. Consult manufacturer's technical representative if written instructions are not applicable to Project conditions.
- C. Remove protective coverings from adjacent surfaces.

**END OF SECTION**

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**SECTION 07 26 00**

**VAPOR RETARDERS**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section Includes: Vapor retarder.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

**1.02 REFERENCES**

- A. ASTM - American Society for Testing and Materials
  - 1. D2582 - Standard Test Method for Puncture-Propagation Tear Resistance of Plastic Film and Thin Sheeting.
  - 2. E96 - Standard Test Methods for Water Vapor Transmission of Materials.
  - 3. E1643 - Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
- B. FS - Federal Specifications
  - 1. SS-C-153C - Cement, Bituminous, Plastic.

**1.03 SUBMITTALS**

- A. Product Data: Submit manufacturer's product data for vapor retarder specified.

**1.04 QUALITY ASSURANCE**

- A. Single-Source Responsibility for Vapor Retarder Products: Obtain vapor retarder from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Protect vapor retarder materials from puncture damage. Comply with manufacturer's recommendations for handling, storage, and protection during installation.

**PART 2 - PRODUCTS**

**2.01 MATERIALS**

- A. Vapor Retarder: Provide vapor retarder of 3 ply, 10 mil or thicker, high-density polyethylene copolymer and nylon yarn laminate, with yarn suspended in a permanently flexible adhesive media. Material shall have a reinforced non-woven grid with a PPT tear strength of not less than 15 pounds, as determined by ASTM D2582, and a water vapor transmission rate (WVTR) of 0.01 perms, as determined by ASTM E96. Provide in widest rolls practical to minimize joints.
  - 1. Product: Stego Industries, "15 Mil Stego Wrap", or equal.
- B. Tape for Vapor Retarder: Pressure sensitive tape of type recommended by vapor retarder manufacturer for sealing joints and penetrations in vapor retarder.
- C. Plastic Cement: FS SS-C-153C, Type I (Asphalt).

### **PART 3 - EXECUTION**

#### **3.01 EXAMINATION**

- A. Examine substrates and conditions with installer present, for compliance with requirements of the Sections in which substrates and related work are specified and to determine if other conditions affecting performance of vapor retarder are satisfactory. Do not proceed with installation of retarder until unsatisfactory conditions have been corrected.

#### **3.02 INSTALLATION**

- A. General
  - 1. Install in accordance with ASTM E1643.
  - 2. Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place. Extend vapor retarder to cover miscellaneous voids in substrates.
- B. Seal overlapping joints in vapor retarders with tape per vapor retarder manufacturer's printed directions. Seal butt joints and fastener penetrations with tape of type recommended by vapor retarder manufacturer.
  - 1. Lap and seal to existing vapor retarder.
- C. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with tape of type recommended by vapor retarder manufacturer to create an airtight seal between penetrating objects and vapor retarder.
- D. Repair any tears or punctures in vapor retarders immediately before concealment by other work. Cover with tape or another layer of vapor retarder.

#### **3.03 PROTECTION**

- A. General: Protect installed vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes.

**END OF SECTION**

**SECTION 07 56 00**

**FLUID-APPLIED ROOFING**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section Includes: Protected, hot fluid-applied roofing membrane.
- B. Products Installed But Not Furnished Under This Section
  - 1. Install flashings and accessories furnished under Section 07 62 00.
- C. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- D. Related Sections
  - 1. Section 07 62 00 - Sheet Metal Flashing and Trim: Provision of flashing, counterflashing, and metal roof penetration flashing.
  - 2. Division 26 - Electrical: Provision of electrical work to be performed above and penetrating roof.

**1.02 REFERENCES**

- A. ASTM - American Society for Testing and Materials
  - 1. D41 - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.
  - 2. D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
  - 3. D624 - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
  - 4. D2137 - Standard Test Methods for Rubber Property-Brittleness Point of Flexible Polymers and Coated Fabrics.
  - 5. D4258 - Standard Practice for Surface Cleaning Concrete for Coating.
  - 6. D4263 - Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
  - 7. D5957 - Standard Guide for Flood Testing Horizontal Waterproofing Installations.
  - 8. E108 - Standard Test Methods for Fire Tests of Roof Coverings.
- B. CGSB - Canadian General Standards Board
  - 1. Hot Applied, Rubberized Asphalt for Roofing and Waterproofing.
- C. UL - Underwriters Laboratories Inc.

**1.03 SYSTEM DESCRIPTION**

- A. Performance Requirements: Install hot fluid-applied roofing and flashing system with compatible components that will not permit passage of liquid and will withstand wind loads, flotation loads, thermally induced movement, and exposure to weather without failure.

**1.04 SUBMITTALS**

- A. Product Data: For each type of roofing material indicated.
- B. Shop Drawings: Show locations and extent of roofing. Include plans, sections, details, and attachments to other Work, for substrate joints and cracks, flashing sheets, roof penetrations, vertical intersections, roof slope, expansion joints, and membrane terminations.

- C. Samples for Verification: Provide 12 inch by 12 inch square of flashing sheet.
- D. Certificates
  - 1. Installer: Signed by manufacturers certifying that installers comply with requirements.
  - 2. Qualification Data: For Installer.
  - 3. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for current formulation of hot fluid-applied roofing.
  - 4. Research/Evaluation Reports: For hot fluid-applied roofing.
  - 5. Maintenance Data: For roofing system to include in maintenance manuals.
  - 6. Warranties: Draft of special warranty specified in this Section.
  - 7. Inspection Report for Information: Copy of roofing system manufacturer's inspection report of completed roofing membrane.

### **1.05 QUALITY ASSURANCE**

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Source Limitations: Obtain roofing membrane materials through one source from a single manufacturer.
- C. Fire Test Response Characteristics: Provide hot fluid-applied roofing with the fire test response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
  - 1. Exterior Fire Test Exposure: Class A; complying with ASTM E108, for application and slopes indicated.
- D. Preinstallation Conference: Before installing roofing system, conduct conference at Project site. Notify participants at least 5 working days before conference.
  - 1. Meet with the Architect, District's insurer, if applicable; testing and inspecting agency representative; roofing installer; roofing system manufacturer's representative; deck installer; and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
    - a. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
    - b. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and attachment to structural members.
    - c. Review loading limitations of deck during and after roofing.
    - d. Review flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing.
    - e. Review governing regulations and requirements for insurance, certifications, and inspection and testing, if applicable.
    - f. Review temporary protection requirements for roofing system during and after installation.
    - g. Review roof observation and repair procedures after roofing installation.
    - h. Document proceedings, including corrective measures or actions required, and furnish copy of record to each participant.

### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Acceptance at Site: Deliver materials to Project site in original containers with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.

**B. Storage and Handling**

1. Handle and store roofing materials and place equipment in a manner to avoid significant or permanent damage to deck or structural supporting members.
2. Protect roofing insulation materials from damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location.

**1.07 PROJECT CONDITIONS**

- A. Environmental Requirements: Apply roofing within the range of ambient and substrate temperatures recommended by roofing system manufacturer. Do not apply roofing to a damp or wet substrate or when temperature is below 0 degrees Fahrenheit.
1. Do not apply roofing in rain, fog or mist.

**1.08 WARRANTY**

- A. Special Roofing Membrane Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace roofing that does not remain watertight and base flashing that does not remain watertight or that splits, tears, or separates at seams or from substrate within specified warranty period.
1. Warranty also includes insulation and roof pavers.
  2. Warranty does not include failure of roofing membrane due to formation of new joints and cracks in roof deck in excess of 1/8-inch wide.
    - a. Warranty Period: 15 years from date of Substantial Completion.

**PART 2 - PRODUCTS**

**2.01 MANUFACTURERS**

- A. Acceptable Manufacturer: American Hydrotech, Inc., "Monolithic Membrane 6125", or equal.

**2.02 ROOFING MEMBRANE**

- A. Single component, 100 percent solids, hot fluid-applied, rubberized asphalt, complying with the general requirements and the following physical requirements in CGSB-37.50, as demonstrated by testing performed by a qualified independent testing agency of manufacturer's current roofing formulations:
1. Flash Point: Not less than 260 degrees Celsius or not less than 25 degrees Celsius above manufacturer's maximum recommended application temperature.
  2. Cone Penetration: 110 maximum at 25 degrees Celsius and 200 maximum at 50 degrees Celsius.
  3. Flow: 3 mm maximum at 60 degrees Celsius.
  4. Toughness: Not less than 5.5 J.
  5. Ratio of Toughness to Peak Load: Not less than 0.040.
  6. Adhesion Rating: Pass.
  7. Water Vapor Permeance: 1.7 ng/Pa x s x sq. m.
  8. Water Absorption: 0.35-g maximum mass gain or 0.18-g maximum mass loss.
  9. Pinholing: Not more than 1 pinhole.
  10. Low-Temperature Flexibility: No cracking.
  11. Crack Bridging Capability: No cracking, splitting, or loss of adhesion.
  12. Heat Stability: Comply with requirements for penetration, flow, low-temperature flexibility, and viscosity when heated for five hours at manufacturer's recommended application temperature.
  13. Viscosity Test: 2 to 15 seconds.

### **2.03 AUXILIARY MATERIALS**

- A. General: Furnish auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing.
- B. Furnish liquid-type auxiliary materials that meet VOC limits of authorities having jurisdiction.
- C. Primer: ASTM D41, asphaltic primer.
- D. Elastomeric Flashing Sheet: 50-mil thick, minimum, nonstaining, uncured sheet neoprene with manufacturer's recommended contact adhesives. Comply with the following:
  - 1. Tensile Strength: 1400 psi minimum; ASTM D412, Die C.
  - 2. Elongation: 300 percent minimum; ASTM D412.
  - 3. Tear Resistance: 125 psi minimum; ASTM D624, Die C.
  - 4. Brittleness: Does not break at minus 30 degrees Fahrenheit; ASTM D2137.
- E. Mortar at Crickets: 2-component, polymer-modified, cementitious, trowel-grade mortar plus penetrating corrosion inhibitor, as manufactured by Sika Corporation, "SikaTop 122 Plus", or equal.
- F. Protection Course: Manufacturer's recommended smooth surfaced, modified bituminous sheet.
- G. Metal Termination Bars: Manufacturer's standard predrilled stainless-steel or aluminum termination bars, approximately 1 inch by 1/8-inch thick; with anchors.
- H. Accessories: Manufacturer's recommended protection course, backer rods, sealants, and other accessories.

## **PART 3 - EXECUTION**

### **3.01 EXAMINATION**

- A. Examine substrates, areas, and conditions under which roofing will be applied, with Installer present, for compliance with requirements and other conditions affecting performance.
  - 1. Proceed with installation only after minimum concrete drying period recommended by roofing system manufacturer has passed.
  - 2. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D4263.
  - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.02 PREPARATION**

- A. Clean and prepare substrate according to manufacturer's written recommendations. Provide clean, dust-free, and dry substrate for roofing application.
- B. Mask off adjoining surfaces not receiving roofing to prevent spillage from affecting other construction.
- C. Protect roof drains and other deck penetrations to prevent spillage and migration of roofing fluids.
- D. Remove grease, oil, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- E. Remove fins, ridges, and other projections and fill honeycomb, aggregate pockets, and other voids.

### **3.03 JOINTS, CRACKS, AND TERMINATIONS**

- A. Prepare and treat substrates to receive roofing membrane, including joints and cracks, roof drains, and penetrations, according to CGSB-37.51 and roofing system manufacturer's written instructions.
  - 1. Rout and fill joints and cracks in substrate. Before filling, remove dust and dirt according to ASTM D4258.
  - 2. Adhere strip of elastomeric flashing sheet to substrate in a layer of hot fluid-applied, rubberized asphalt. Extend flashing sheet a minimum of 6 inches on each side of moving joints and cracks or joints and cracks exceeding 1/8-inch thick, and beyond roof drains and penetrations. Apply second layer of hot fluid-applied, rubberized asphalt over elastomeric flashing sheet.
  - 3. Embed strip of reinforcing fabric into a layer of hot fluid-applied, rubberized asphalt. Extend reinforcing fabric a minimum of 6 inches on each side of nonmoving joints and cracks not exceeding 1/8-inch thick, and beyond roof drains and penetrations.
- B. At expansion joints and discontinuous deck-to-wall or deck-to-deck joints, bridge joints with elastomeric flashing sheet extended a minimum of 6 inches on each side of joints and adhere to substrates in a layer of hot fluid-applied, rubberized asphalt. Apply second layer of hot fluid-applied, rubberized asphalt over elastomeric reinforcing sheet.

### **3.04 BASE FLASHING INSTALLATION**

- A. Install base flashing at terminations of roofing membrane according to CGSB-37.51 and roofing system manufacturer's written instructions.
  - 1. Prime substrate with asphalt primer if required by roofing membrane manufacturer.
  - 2. Bond elastomeric flashing sheet in adhesive against wall substrate to within 3 inches of deck. Adhere remaining vertical leg and horizontal leg of flashing sheet in a layer of hot fluid-applied, rubberized asphalt.
  - 3. Bond modified bituminous flashing sheet to substrate by adhering modified bituminous flashing sheet to substrate in a layer of hot fluid-applied, rubberized asphalt.
  - 4. Extend flashing sheet up walls or parapets a minimum of 8 inches above deck and 6 inches onto roof deck.
  - 5. Install termination bars and mechanically fasten to top of flashing sheet at terminations and perimeter of roofing.

### **3.05 ROOFING MEMBRANE APPLICATION**

- A. Apply primer, at manufacturer's recommended rate, over prepared substrate and allow to dry.
- B. Heat and apply rubberized asphalt according to CGSB-37.51 and manufacturer's written instructions.
  - 1. Heat rubberized asphalt in an oil or air jacketed melter with mechanical agitator specifically designed for heating rubberized asphalt.
- C. Unreinforced Membrane: Apply hot fluid-applied, rubberized asphalt to area to receive roofing. Spread hot fluid-applied, rubberized asphalt to form a uniform, unreinforced, seamless membrane, 180 mils average, but not less than 125 mils thick.
- D. Apply hot fluid-applied, rubberized asphalt over prepared joints and up wall terminations and vertical surfaces to heights indicated or required by manufacturer.
- E. Cover roofing membrane with separator sheet with overlapped joints while rubberized asphalt is still hot and before roofing membrane is subject to traffic.
- F. Install protection course with overlapped joints over separator sheet.

### **3.06 FIELD QUALITY CONTROL**

- A. The District will engage a qualified testing agency to observe flood tests and to determine and report leaks.
- B. Flood Testing: Flood test each roof deck area for leaks, according to recommendations in ASTM D5957, after completing roofing and flashing, but before overlying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.
  - 1. Flood to an average depth of 2-1/2 inches with a minimum depth of 1 inch and not exceeding a depth of 4 inches. Maintain 2 inches of clearance from top of base flashing.
  - 2. Flood each area for 24 hours.
  - 3. After flood testing, repair leaks, repeat flood tests, and make further repairs until roofing and flashing installation is watertight.
- C. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion of roofing membrane and flashing.
  - 1. Notify the Architect and the District 48 hours in advance of date and time of inspection.
- D. Correct deficiencies in or remove roofing that does not comply with requirements, repair substrates, reapply roofing, and repair flashing.
  - 1. After flood tests, repair leaks and make further repairs until roofing installation is watertight.
- E. Additional testing, at the Contractor's expense, will be performed to determine compliance of corrected Work with requirements.

### **3.07 PROTECTING AND CLEANING**

- A. Protect roofing according to manufacturer's written recommendations to prevent damage and wear during application and remainder of construction period.
- B. Protect installed insulation from damage due to UV-light exposure, physical abuse, and other causes. Provide temporary coverings where insulation will be subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
- C. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

**END OF SECTION**



**SECTION 07 61 00**

**SHEET METAL ROOFING**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section Includes: Pre-finished galvanized sheet steel roofing system, including but not limited to the following:
  - 1. Pre-finished roof panels and associated flashings and panel attachment devices.
  - 2. Waterproof membrane.
  - 3. Thermal insulation.
  - 4. Slip-sheet (if required).
  - 5. Pre-finished valley flashing, gutters, rain water leaders, and splash pans.
  - 6. Pre-finished copings, fascias, and closure flashing between fascias and face of wall below roof deck.
  - 7. Soffit panels and accessories.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- C. Related Sections
  - 1. Section 01 31 19 - Project Meetings: For pre-installation conference requirements.
  - 2. Section 01 60 00 - Product Requirements: For product storage and handling requirements.
  - 3. Section 06 10 00 - Rough Carpentry: Provision of pressure-treated wood nailers.
  - 4. Section 07 61 00 - Sheet Metal Roofing: Provision of sheet metal roofing system.
  - 5. Section 07 62 00 - Sheet Metal Flashing and Trim: Provision of miscellaneous sheet metal flashing and trim.
  - 6. Section 07 92 00 - Joint Sealants: Provision of sealers and caulks.

**1.02 REFERENCES**

- A. AAMA - American Architectural Manufacturers Association
  - 1. 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
- B. ASTM - American Society for Testing and Materials
  - 1. A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - 2. A792 - Standard Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
  - 3. C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
  - 4. C1177 - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
  - 5. D226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
  - 6. D1970 - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
  - 7. E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
  - 8. E1646 - Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference.
  - 9. E1680 - Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems.

- C. CBC - California Building Code, 2007 Edition
- D. CCR - California Code of Regulations
- E. FM - Factory Mutual
  - 1. 4471 - Approval Standard for Class I Panel Roofs.
- F. SMACNA - Sheet Metal and Air Conditioning Contractors National Association
  - 1. Architectural Sheet Metal Manual.
- G. UL - Underwriter's Laboratories Inc.
  - 1. 580 - Tests for Uplift Resistance of Roof Assemblies.

**1.03 SYSTEM DESCRIPTION**

- A. Design Requirements
  - 1. Install sheet metal roofing and soffit assemblies capable of withstanding normal thermal movement, wind loading, structural movement, thermally induced movement and exposure to weather without failure or infiltration of water into the building interior.
  - 2. System shall be approved by the manufacturer for applications on slopes of 1/4-inch/foot or greater.
  - 3. Over structural metal deck, provide extruded polystyrene thermal insulation, a non-combustible cover board, a waterproof membrane, a slip sheet if required, and a standing seam metal roof.
  - 4. Provide self-adhering sheet flashing at valleys and other areas where slopes are less than 1/4-inch per foot.
  - 5. Metal roof systems shall be provided as complete systems, under one responsibility. All components of the metal roofing panels shall be supplied by 1 manufacturer.
    - a. Panels shall be pre-formed to the final profile and configuration in the factory, except for field formed seams. Panels shall be continuous lengths to produce the lap pattern as shown for each roof. Ribs of adjoining sheets shall be in continuous contact from eave to ridge.
    - b. Field roll-forming not permitted, except for minor flashing and transition pieces.
    - c. There shall be no exposed or penetrating fasteners except where shown on approved shop drawings. Fasteners shall be stainless steel, or corrosion resistant coated steel. There shall be a minimum of two fasteners per panel clip.
    - d. Panel seams shall be of the double lock design. Field formed seams shall be mechanically locked by panel manufacturer's locking tool. Seam shall include a continuous factory applied sealant.
    - e. Roof panel anchor clips shall be concealed and designed to allow for longitudinal thermal movement of the panels, except where specific fixed points are indicated. Panel end laps shall be continuously cleated and allow for thermal movement.
  - 6. Design Loads
    - a. Wind Uplift
      - 1) Design load applications shall be in accord with CBC and with recognized methods of evaluation.
      - 2) Design uplift pressures for the roof system shall be computed and applied using a basic wind speed of 70 mph and Exposure C. Roof system and attachments shall resist the following minimum wind loads, or greater if required to comply with specified windstorm classification:

Location	Negative Pressure (psf)
a) At eaves:	36.5 psf within 10 feet
b) At rakes:	36.5 psf within 10 feet

- c) At ridges: 36.5 psf within 10 feet
  - d) At building corners:
  - e) At overhangs: 44.5 psf within 10 feet
  - f) At central areas: 20.6 psf within 10 feet
- 3) Design uplift force for each connection assembly shall be that pressure given for the area under consideration, multiplied by the tributary load area of the connection assembly, and multiplied by a factor of safety of 2.0.
- b. Thermal Effects: Roof panels shall be free to move in response to expansion and contraction forces resulting from maximum local temperature variations, based on a range of 10 degrees Fahrenheit minimum to 170 degrees Fahrenheit maximum.
- c. Rainfall: Gutters and rain water leaders shall be designed for rainfall intensity based on 100 year storm criteria as given in the SMACNA manual, unless local experience requires a greater intensity.
7. Panel Anchorage System
- a. Method shall incorporate the use of bearing plates on top of the insulation, under the waterproof membrane. Bearing plates shall be attached separately to the structural metal deck. Plate locations shall be designed so that the plate fasteners penetrate only the top flutes of the structural metal deck. Panel clips shall attach to the bearing plates with a minimum of two fasteners.
  - b. Bearing plate size, thickness and fasteners shall be as required by calculations to resist wind uplift and thermal loads. All materials shall be corrosion resistant.
  - c. Panel clips, except at specified fixed points, shall be of a design to allow for thermal expansion and contraction, to an extent as calculated by factors including panel material coefficient of expansion, panel length, and temperature ranges.
  - d. Supplemental furring shall be provided as required to support transitions, flashings, gutters, fascias, etc.
8. Accessories and Fasteners
- a. All fasteners and accessories shall be corrosion resistant and compatible.
  - b. Accessories and fasteners shall be capable of resisting the calculated wind and thermal loads, to comply with performance requirements for windstorm classification.
  - c. Fasteners shall not restrict free movement of roof panel system resulting from thermal forces, except at designed points of roof panel fixity.
  - d. Panel clip fasteners shall be as required by calculations to resist wind uplift and thermal loads.
  - e. Any exposed fasteners shall be of a low profile (i.e., "pancake head") fastener head design to minimize wear points and potential damage or perforation of the panel.
- B. Performance Requirements
- 1. Metal roofing and soffit panel systems shall comply with specified wind uplift resistance criteria, and shall have a performance equivalent to that required to achieve a windstorm classification of 1-90 when tested in accord with FM 4471 or UL 90 when tested in accord with UL Test Method 580.
  - 2. Metal roof and soffit panel systems shall be designed for negative loading. Determine panel bending and clip-to-panel strength. Capacity for gauge, span, or loading other than those tested may be determined by interpolating between test values only. Compute uplift loads on anchor screws with full recognition of prying forces from eccentric clip loading. Calculate holding strength of fasteners in accordance with the thickness or length of embedment and properties of the material holding the point. Include factors of safety as specified.
  - 3. Metal roof panel shall have a maximum air infiltration rate of 0.002 - 0.003 cfm/ft<sup>2</sup> at a pressure differential of minimum 12 psf when tested in accordance with ASTM E1680.
  - 4. Metal roof panel shall have no uncontrollable water leakage at a minimum pressure differential of 20 psf when tested in accordance with ASTM E1646.

5. Metal roof panel shall be tested in accordance with UL test method for impact resistance. Materials shall meet or exceed Class 4.

#### **1.04 SUBMITTALS**

- A. Product Data: Submit product data for each product indicated. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes.
- B. Shop Drawings
  1. Show details for forming, joining, and securing metal roofing, and for pattern of seams.
  2. Show expansion joint details and waterproof connections to adjoining work and at obstructions and penetrations.
  3. Show insulation layout.
  4. Show fastening methods and fastener patterns, anchoring methods, provisions for thermal movement, and installation details.
  5. Show details for forming, joining, and securing metal soffits and for pattern of seams.
- C. Product Data: Submit data on the following:
  1. Roofing panels including profile, finish, typical details, and panel attachment devices.
  2. System attachment components including clips and bearing plates.
  3. Insulations.
  4. Waterproof membrane.
  5. Self-adhering sheet membrane flashing
  6. Slip sheet.
  7. Soffit panels including profile, finish, typical details, and panel attachment devices.
- D. Samples
  1. Submit 2 samples 24 inches by panel width in size of metal roofing mounted on plywood backing illustrating typical seam, material, and finish.
  2. Submit 2 samples 24 inches by panel width in size of metal soffit mounted on plywood backing illustrating typical seam, material, and finish.
  3. Submit a 12-inch sample of each trim profile.
- E. Test Reports: Submit copies of all laboratory test reports required by this Section. Test reports shall be certified. Testing shall be conducted at approved laboratories and/or under the direct supervision of an independent engineer licensed in California as required for the types of tests conducted.

#### **1.05 QUALITY ASSURANCE**

- A. Qualifications
  1. Manufacturer
    - a. Manufacturer shall have a minimum of 5 years experience in manufacturing metal roofing systems. Panels specified in this section shall be produced in a permanent factory environment with fixed-base roll-forming equipment. A letter certifying the manufacturer's qualifications shall accompany the product material submittals.
    - b. Manufacturer shall have been involved in at least 5 projects similar in size and complexity to this project.
    - c. Roofing and soffit panels, clips, closures and other accessories shall be standard products of the same manufacturer; shall be the latest design by the manufacturer; and shall have been designed by the manufacturer to operate as a complete system for the intended use.
  2. Manufacturer's Representative: Manufacturer shall employ a representative having authorization from manufacturer to approve field changes and be thoroughly familiar with the products and with installation in the geographical area where construction will take place. Representative shall

have at least 5 year's experience installing project of similar scope and magnitude.  
Representative shall be available to perform field inspections and attend meetings.

3. The Installer shall meet the following minimum criteria:
  - a. Be factory trained and approved by the manufacturer to install the specified system, and shall have a minimum of three year's experience as an approved installer for the manufacturer.
  - b. Have installed five projects of similar scope and magnitude that have been in service for a minimum of three years with satisfactory performance of the roof system.
- B. Mockups
  1. Construct a mockup at project site for Architect's review and approval.
  2. Mockup shall include the following:
    - a. Minimum of 2 roofing panels, with specified finish, maximum length for project, seamed together.
    - b. Typical ridge and eave fascias, flashing. Typical eave gutter section.
    - c. Typical rake fascia on one side.
    - d. Minimum of 2 soffit panels with specified finish, installed with matching trim profiles.
  3. Mockup, when approved, shall serve as a standard of quality for actual installation.
- C. Pre-Installation Conference
  1. Comply with requirements of Section 01 31 19.
  2. Convene minimum one week prior to commencing Work of this section.

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Product Storage and Handling: Comply with requirements of Section 01 60 00.
- B. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- C. Prevent contact with materials causing discoloration or staining.

#### **1.07 WARRANTY**

- A. Warranty: Manufacturer agrees to repair or replace components of sheet metal roofing that fail in materials or workmanship within specified warranty period.
  1. Failures include, but are not limited to, the following:
    - a. Structural failures, including but not limited to, rupturing, cracking, or puncturing.
    - b. Wrinkling or buckling.
    - c. Loose parts.
    - d. Failure to remain weathertight, including uncontrolled water leakage.
    - e. Deterioration of metals, metal finishes, and other materials beyond normal weathering, including non-uniformity of color or finish.
    - f. Galvanic action between sheet metal roofing and dissimilar materials.
  2. Warranty Period: 20 years; "WEAthertight, Platinum", no dollar limit.
- B. Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace sheet metal roofing that shows evidence of deterioration of factory-applied finishes within specified warranty period.
  1. Warranty Period: 25 years from date of Substantial Completion.

## **PART 2 - PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Acceptable Manufacturers
  - 1. AEP Span, "Span-Lok", double lock standing seam, 16 inch rib spacing, 2 inch high seam (before field seaming), with optional 1/2-inch wide stiffening ribs.
  - 2. Copper Sales, Inc., "Una-Clad UC-3", double lock standing seam, 18 inch rib spacing, 2 inch high seam (before field seaming), with optional 1/2 inch wide stiffening ribs.
  - 3. Substitutions: Comply with requirements of Section 01 60 00.

### **2.02 MATERIALS**

- A. Sheet Metal Roofing:
  - 1. Pre-Finished Galvanized Steel Sheet
    - a. For Span-Lok: ASTM A792, AZ50 aluminum-zinc alloy coating; 24 gauge core steel; shop pre-coated with PVDF (polyvinylidene fluoride) coating.
      - 1) Color: Cool Champagne Metallic.
    - b. For Una-Clad UC-3: ASTM A653, G90 (Z275) zinc coating; 24 gauge core steel; shop pre-coated with PVDF (polyvinylidene fluoride) coating.
      - 1) Color: Cool Champagne Metallic.
    - c. Coil stock shall be tension leveled and re-squared before panel fabrication to minimize oil canning.
  - 2. Coatings
    - a. Exposed Surfaces: Polyvinylidene fluoride (PVDF) high performance organic finish, AAMA 2605, multiple coat, thermally cured fluoropolymer finish system, minimum 70 percent resin content, low gloss finish; Kynar 500; Hylar 5000; minimum thickness (not average or nominal) 1.0 mil dry film thickness.
    - b. Panel Underside: Wash coat, 0.5 mil dry film thickness.
    - c. Provide clear factory edge coating on all factory cut or unfinished edges.
- B. Cover Board: ASTM C1177, glass-mat, water-resistant gypsum substrate with pre-primed surfaces on front and back, 1/4-inch thick, unless otherwise indicated. Maximum flame-spread and smoke-developed indices of 0, per ASTM E84.
  - 1. Product: Georgia Pacific Corporation, "DensDeck Prime Roof Board", or equal.
- C. Roofing Felt: 2 layers, ASTM D226, Type II, nominal 30 lb/100 sf.
  - 1. Product: Owens-Corning Fiberglass Corp., or equal.
- D. Self-Adhering Sheet Membrane (SASM): ASTM D1970; cold applied, self-adhering reinforced polyethylene film with rubberized asphalt adhesive coating on one side.
  - 1. Product: Grace Construction Products, "Ultra", for high temperature conditions.
- E. Slip Sheet: If required to prevent adhesion of roofing panels to waterproof membrane and/or to protect wash coat at underside of roofing panels from abrasion, provide minimum 5 lb./100 sq. ft. rosin sized or unsaturated building paper.
- F. Insulation
  - 1. General
    - a. Comply with California Energy Code, CCR Title 24, Part 6, Subchapter 2, Section 118: Certification that insulation complies with California Quality Standards for Insulating Material (CCR Title 20, Chapter 4, Article 3).

- b. Comply with CBC: Flame spread rating not to exceed 25 and smoke density not to exceed 450 when tested in accordance with CBC.
      - c. Blowing agent to have zero ozone depletion potential.
    2. Extruded Polystyrene: ASTM C578, Type IV; 25 psi minimum compressive strength; 2 inches thick; mechanically fastened.
      - a. Product: Dow, "Styrofoam Deckmate Plus"; Owens Corning, "FOAMULAR 250", or equal.
      - b. Substitutions: No known equal to polystyrene for water and fire resistance.
  - G. Accessories
    1. Joint Tape: Protecto-Wrap BT20; 3M Contractor Sheathing Tape No. 8086; Polyguard Products, or equal.
    2. Sealant: 2-component polyurethane, as specified in Section 07 92 00.
    3. Fascias, Gutters, Rainwater Leaders, Flashing: Of same material and finish as roof panels.
  - H. Soffit Panels: AEP Span, "Prestige Series" 12-inch wide flat pan design; provide with matching trim profiles and accessories.

### **2.03 FABRICATION - GENERAL**

- A. General: Fabricate sheet metal roofing to comply with details shown, with metal roofing manufacturer's written instructions, and with recommendations of SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of installation indicated.
- B. Fabricate sheet metal to allow for expansion in running work sufficient to prevent leakage, damage, and deterioration of the Work. Form exposed sheet metal work to fit substrates without excessive oil canning, buckling, and tool marks, true to line and levels indicated, and with exposed edges folded back to form hems.
- C. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, or would not be sufficiently waterproof and weatherproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant (concealed within joints).
- D. Sealant Joints: Where movable, nonexpansion-type joints are indicated or required to produce weathertight seams, form metal to provide for proper installation of elastomeric sealant, in compliance with SMACNA standards.
- E. Separations: Separate metal from noncompatible metal or corrosive substrates by coating concealed surfaces at locations of contact with bituminous coating or other permanent separation as recommended by manufacturer or fabricator.

### **2.04 FABRICATION - ROOF PANELS AND RELATED COMPONENTS**

- A. Field roll-forming not permitted, except for minor flashing and transition pieces.
- B. Form sections to shapes as indicated on Drawings, accurate in size, square, and free from distortion or defects.
  1. Panel spacing: Equally spaced within range of specified by manufacturer or as shown on drawings.
- C. Fabricate cleats of same material as sheet, to interlock with sheet.

- D. Fabricate starter strips of same material as sheet, continuous, to interlock with sheet.
- E. Panels shall be continuous lengths to produce the lap pattern as shown for each roof.
- F. Hem exposed edges on underside 1/2 inch; miter and seam corners.
- G. Form material with double lock standing seams, except where otherwise indicated. At moving joints, use sealed lapped, interlocking hooked seams.
- H. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.
- I. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.
- J. Fabricate flashings to allow toe to extend 2 inches over roofing, unless otherwise shown. Return and brake edges.

### **PART 3 - EXECUTION**

#### **3.01 PREPARATION**

- A. Coordinate metal roofing and soffits with rain drainage work, flashing, trim and construction of decks, walls and other adjoining work to provide a leakproof, secure and noncorrosive installation.
- B. Promptly remove protective film, if any, from exposed surfaces of metal roofing and soffits. Strip with care to avoid damage to finish.

#### **3.02 EXAMINATION**

- A. Inspect metal roof deck to verify deck is clean and smooth, free of depressions, waves, or projections, and properly sloped to eaves.
- B. Verify deck is dry.
- C. Verify roof openings, pipes, sleeves, or vents through roof are solidly set.

#### **3.03 GENERAL INSTALLATION REQUIREMENTS**

- A. Install roofing to comply with sheet metal roofing manufacturer's written instructions, unless otherwise indicated.
- B. Separate dissimilar metals by painting each metal surface in area of contact with a bituminous coating, by applying rubberized-asphalt underlayment to each metal surface, or by other permanent separation as recommended by manufacturers of dissimilar metals.
- C. Install waterproof membrane and building paper slip sheet if required on substrate under metal roofing, as recommended by sheet metal manufacturer. Use adhesive for temporary anchorage, where possible, to minimize use of mechanical fasteners under metal roofing. Apply from eave to ridge in shingle fashion and lap joints 2 inches minimum.
- D. Form and fabricate sheets, seams, strips, cleats, valleys, ridges, edge treatments, integral flashings, and other components of metal roofing to profiles, patterns, and drainage arrangements shown and as required for leakproof construction. Provide for thermal expansion and contraction of the Work. Seal



- joints as shown and as required for leakproof construction. Shop fabricate materials to greatest extent possible.
- E. Sealant-Type Joints: Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature is moderate, between 40 and 70 degrees Fahrenheit, at time of installation, set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 degrees Fahrenheit. Comply with requirements of Section 07 92 00 for handling and installing sealants.
  - F. Fabricate and install work with lines and corners of exposed units true and accurate. Form exposed faces flat and free of buckles, excessive waves, and avoidable tool marks, considering temper and reflectivity of metal. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant. Fold back sheet metal to form a hem on concealed side of exposed edges, unless otherwise indicated.
  - G. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation. Spacing of fasteners shall not exceed 48 inches on center.

### **3.04 INSTALLATION**

- A. Deck Closures: Install preformed closures in deck flutes.
- B. Insulation
  - 1. All insulation is to be mechanically fastened.
  - 2. Lay boards with edges in moderate contact without forcing.
  - 3. Seal all joints with joint tape.
- C. Install bearing plate system in accord with approved design. Locate plates so that fasteners penetrate only the top flutes of metal deck.
- D. Cover Board: Install in accordance with manufacturer's written instructions and as indicated on the Drawings.
- E. Waterproof Membrane: Install continuously over entire surface to be covered by metal roof system. Weather lap joints minimum 2 inches, or as recommended by membrane manufacturer.
  - 1. Where slope of roof is less than 1/4-inch in 12 inches, install self-adhering waterproof membrane extending 4 feet beyond the flow line in each direction.
- F. Install fascias, gutters, downspouts, and metal splash pans.
- G. Standing Seam Roofing Installation
  - 1. Conform to manufacturer's instructions and approved installation drawings.
  - 2. Install starter and edge strips, and cleats before starting installation.
  - 3. Locate standing seams equally spaced within range specified by manufacturer or as shown in drawings.
  - 4. Lay sheets with long dimension perpendicular to eaves. Apply panels beginning at eaves.
  - 5. Lock cleats into seams. Allow for thermal movement.
  - 6. Stagger transverse joints of roofing sheets as shown.
  - 7. At eaves and gable ends, terminate roofing by hooking over edge strip.
  - 8. Finish standing seams to 1-1/2 inch high.
  - 9. Provide locked standing seam.

10. Fold lower ends of seams at eaves over at 45 degree angle.
11. Terminate standing seams at ridge and hips by turning down with tapered fold.

H. Flashing Installation

1. Secure flashings in place using concealed fasteners.
2. Cleat and seam joints.
3. Apply plastic cement compound between metal flashings and felt flashings.
4. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.
5. Seal metal joints watertight.

I. Soffit Installation

1. Secure panels with concealed fasteners.
2. Provide prefinished trim profiles at perimeter and at all cut edges.

**3.05 PROTECTION OF INSTALLED CONSTRUCTION**

- A. Do not permit traffic over unprotected roof surface.

**END OF SECTION**

**SECTION 07 62 00**

**SHEET METAL FLASHING AND TRIM**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section Includes
  - 1. Painted galvanized sheet metal flashing and counterflashing.
  - 2. Double bottom gutter.
  - 3. Hard pipe downspout.
  - 4. Exposed metal trim.
  - 5. Miscellaneous sheet metal accessories.
  - 6. Elastic flashing.
- B. Products Furnished But Not Installed Under This Section: Sheet metal flashing and trim associated with the following Section.
  - 1. Section 07 56 00 - Fluid-Applied Roofing: Provision of fluid-applied roofing.
  - 2. Section 07 61 00 - Sheet Metal Roofing: Provision of sheet metal roofing.
- C. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- D. Related Sections
  - 1. Section 05 50 00 - Metal Fabrications: For protection of dissimilar metals.
  - 2. Section 07 92 00 - Joint Sealants: Provision of sealants.

**1.02 REFERENCES**

- A. ASTM - American Society for Testing and Materials
  - 1. A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
  - 2. A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - 3. B32 - Standard Specification for Solder Metal.
  - 4. D2822 - Standard Specification for Asphalt Roof Cement, Asbestos Containing.
- B. AWS - American Welding Society
- C. SMACNA - Sheet Metal and Air Conditioning Contractors National Association, Inc.
  - 1. Architectural Sheet Metal Manual.
- D. SSPC - The Society for Protective Coatings
  - 1. Paint 12 - Paint Specification No. 12: Cold-Applied Asphalt Mastic (Extra Thick Film).

**1.03 SYSTEM DESCRIPTION**

- A. Performance Requirements
  - 1. Work of this Section shall physically protect roofing and other items as indicated from damage that would permit water leakage to building interior.
  - 2. Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement and exposure to weather without failing.

#### **1.04 SUBMITTALS**

- A. Setting Drawings or Templates: Submit setting drawings or templates and setting instructions, for exact locations.

### **PART 2 - PRODUCTS**

#### **2.01 MATERIALS**

- A. Zinc-Coated Steel Sheet: Commercial quality with 0.20 percent copper, ASTM A653, G90 hot-dip galvanized, mill phosphatized where indicated for painting; 20 gauge except as otherwise indicated.
- B. Steel Pipe: ASTM A53, standard weight (Schedule 40) unless otherwise indicated.
- C. Elastic Sheet Flashing/Membrane: Nonreinforced flexible, black elastic sheet flashing of 50 to 60 mils thickness.
  - 1. Product: Tremco, "Hypalon Elastomeric Sheeting"; Fortifiber, or equal.
- D. Elastic Sheet Flashing Membrane: Self-adhering flashing comprised of high-density, polyethylene carrier film pressure sensitive adhesive layer.
  - 1. Product: Grace Construction Products, "Vycor Plus"; Tyco Plastics and Adhesives, "Polyken 627-20 Black Window Flashing Tape", or equal.
- E. Surface Reglet and Counterflashing: Fry Reglet, "Type SM", or equal, except as otherwise indicated.
- F. Miscellaneous Materials and Accessories
  - 1. Solder and Flux: For use with steel, provide 50 - 50 tin/lead solder, ASTM B32, with rosin flux. Re-melted or reworked solder will not be permitted.
  - 2. Fasteners: Same metal as flashing/sheet metal or other noncorrosive metal as recommended by sheet manufacturer. Match finish of exposed heads with material being fastened.
  - 3. Bituminous Coating: SSPC Paint 12, solvent type bituminous mastic, nominally free of sulfur, compounded for 15 mil dry film thickness per coat.
  - 4. Metal Accessories: Provide sheet metal clips, straps, anchoring devices and similar accessory units as required for installation of work, matching or compatible with material being installed, noncorrosive, size and gauge required for performance.
  - 5. Elastic Flashing Filler: Closed-cell polyethylene or other soft closed cell material recommended by elastic flashing manufacturer as filler under flashing loops to ensure movement with minimum stress on flashing sheet.
  - 6. Roofing Cement: ASTM D2822, asphaltic.
- G. Materials for Permanent Protection of Dissimilar Materials: As specified in Section 05 50 00.

#### **2.02 FABRICATION**

- A. Shop Assembly
  - 1. Design and fabricate work in accordance with SMACNA, unless otherwise indicated.
  - 2. As far as practicable, form and fabricate sheet metal in shop. Where on-site fabrication is required, provide work equal to shop quality. Additionally, identify bulk materials from which items are field fabricated by manufacturer's trademark printed or embossed at frequent intervals.
  - 3. Reproduce accurately profiles and bends indicated.
  - 4. Provide profiles with interactions that are sharp, even and true; with plane surfaces free from buckles and waves; and seams that follow direction of water flow.
  - 5. Reinforce correctly for strength and appearance.
  - 6. Cut, fit, and drill sheet metal as required to accommodate related, adjacent or adjoining work.

7. Exposed Edges of Sheet Metal: Fold, bend or return exposed edges of sheet metal. Raw edges will not be permitted.
  8. Form pieces in longest practical lengths.
- B. Sheet Metal Joints
1. In general, provide lock joints; where impractical, lap, rivet, solder, or weld joints, or join as otherwise recommended by manufacturer.
  2. Join joints and miters as recommended by manufacturer.
  3. Where positive joining is required, weld in accordance with applicable AWS standards.
  4. Turn lock joints on exposed surfaces in direction of flow.
- C. Soldering
1. Neatly solder exposed surfaces.
  2. Pre-tin edges minimum 1-1/2 inches both sides prior to soldering.
  3. Solder and seal metal joints. After soldering, remove flux. Wipe and wash solder joints clean.
- D. Expansion and Contraction of Sheet Metal Runs
1. General: Provide loose locking slip joint of maximum 8 feet from external and internal corners, maximum 24 feet length of straight runs, unless manufacturer recommends more frequent interval, and 1 at center of runs less than 20 feet, but more than 8 feet, unless specified otherwise following herein.
- E. Provide the following items of materials and minimum gauges as indicated:
1. Cleats: Formed of same metal as that being anchored, with size, shape, and quantity as required to secure flashing and sheet metal work in place.
  2. Base Flashing, Counter Flashing and Roof Penetration Flashing
    - a. Formed with 3/4-inch locked and soldered seams, assembled into units not longer than 16 feet.
    - b. Join units with 3/4-inch wide loose locked seams filled with soft grade butyl base compound, before units are assembled.
    - c. Mitre corners and joints by riveted or locked and soldered joints.

## **2.03 FINISHES**

- A. Galvanized Sheet Metal
1. Factory Finishing
    - a. Finish: G90, conforming to ASTM A653.
    - b. After Fabrication: Touch-up abraded surfaces in accordance with Section 09 90 00.
  2. Finish Painting: As specified in Section 09 90 00.
- B. High-Performance Organic Finish: As specified in Section 07 61 00.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. Conform with procedures and methods of installation and applicable details shown and described in SMACNA Manual.
- B. Where installation requires fabrication at the Project site, conform to applicable requirements of Article titled "Fabrication" in this Section.
- C. Install standard catalog products in accordance with manufacturer's instructions, unless otherwise indicated.

- D. Install work watertight; ensure that items are installed in true and accurate alignment with other items and related work, that joints are accurately fitted, that corners are reinforced and that exposed surfaces are free of dents.
- E. Apply flashing compound at slip joints or wherever metal-to-metal contact occurs and movement may be anticipated to occur.
- F. Flashings
  - 1. Fasten sheet metal runs to underlaying material by nailing through slotted holes in flange at 3 inches on center, unless otherwise indicated or required by manufacturer.
  - 2. Provide waterproof washers wherever fasteners penetrate flashings.
- G. Coping: Provide with butt seam with backup plates every 10 feet, fastened in accordance with SMACNA.

### **3.02 ADJUSTING**

- A. Replace damaged material with new.

### **3.03 SCHEDULE**

- A. Fabricate sheet metal items in thickness or weight needed to comply with performance requirements but not less than that listed below for each application and metal.
  - 1. Double Bottom Gutter: Galvanized steel, 0.0276-inch thick.
  - 2. Hard Pipe Downspout: Galvanized steel, 0.0217-inch thick.
  - 3. Exposed Trim, Except as Indicated: Galvanized steel, 0.0276-inch thick.
  - 4. Base Flashing: Galvanized steel, 0.0276-inch thick.
  - 5. Counterflashing: Galvanized steel, 0.0217-inch thick.
  - 6. Flashing Receivers: Galvanized steel, 0.0217-inch thick.
  - 7. Drip Edges: Galvanized steel, 0.0217-inch thick.
  - 8. Eave Flashing: Galvanized steel, 0.0217-inch thick.
  - 9. Equipment Support Flashing: Galvanized steel, 0.0276-inch thick.
  - 10. Roof Penetration Flashing: Galvanized steel, 0.0276-inch thick.
  - 11. Cap Flashing and Fascia: Galvanized steel, 0.0516-inch thick.
  - 12. Coping: Galvanized steel, 0.0276-inch thick.

**END OF SECTION**

## **SECTION 07 84 00**

### **FIRESTOPPING**

#### **PART 1 - GENERAL**

##### **1.01 SUMMARY**

- A. Section Includes
  - 1. Firestopping and smoke seal materials as indicated as well as the following areas:
    - a. All openings in fire rated floors and wall assemblies, both blank (empty) and those accommodating penetrating items such as cables, conduits, pipes and ducts.
  - 2. One installer shall have sole responsibility for installation of fire stopping for entire Project, including Mechanical and Electrical work.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- C. Related Sections
  - 1. Division 22 - Plumbing: Penetrations for plumbing work.
  - 2. Division 23 - Heating, Ventilating, and Air Conditioning (HVAC): Penetrations for mechanical work.
  - 3. Division 26 - Electrical: Penetrations for electrical work.

##### **1.02 REFERENCES**

- A. ASTM - American Society for Testing and Materials
  - 1. E84 - Test Method for Surface Burning Characteristics of Building Materials.
  - 2. E119 - Method for Fire Tests of Building Construction and Materials.
  - 3. E814 - Standard Test Methods for Fire Tests of Through-Penetration Fire Stops.
- B. CBC - California Building Code, 2007 Edition
- C. CFR - Code of Federal Regulations
  - 1. 40 CFR Part 763, Subpart F, Appendix A, Section 1 - Polarized Light Microscopy.
- D. Intertek Testing Agency
- E. UL - Underwriters Laboratories Inc.
  - 1. 1479 - Standard for Fire Tests of Through-Penetration Firestops.
  - 2. BMD - Building Materials Directory
  - 3. FRD - Fire Resistance Directory

##### **1.03 SYSTEM DESCRIPTION**

- A. Performance Requirements
  - 1. General: F-Rated Through Penetration Firestop Systems: Provide through penetration firestop systems with F ratings indicated, as determined per ASTM E814, but not less than that equaling or exceeding the fire resistance rating of the constructions penetrated.
  - 2. T-Rated Through Penetration Firestop Systems: Provide through penetration firestop systems with T ratings, in addition to F ratings, as determined per ASTM E814, where indicated and where systems protect penetrating items exposed to contact with adjacent materials in occupiable floor areas. T-rated assemblies are required where the following conditions exist:
    - a. Where firestop systems protect penetrations located outside of wall cavities.

- b. Where firestop systems protect penetrating items larger than a 4 inch diameter nominal pipe or 16 square inch in overall cross-sectional area.
3. Fire Resistive Joint Sealants: Provide joint sealants with fire resistance ratings indicated, as determined per ASTM E119, but not less than that equaling or exceeding the fire resistance rating of the construction in which the joint occurs.
4. For firestopping exposed to view, traffic, moisture, and physical damage, provide products that do not deteriorate when exposed to these conditions.
  - a. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture resistant through penetration firestop systems.
  - b. For penetrations involving insulated piping, provide through penetration firestop systems not requiring removal of insulation.
5. For firestopping exposed to view, provide products with flame spread values of less than 25 and smoke developed values of less than 450, as determined per ASTM E84.

#### **1.04 SUBMITTALS**

- A. Product Data: Submit manufacturer's data on product characteristics, performance and limitation criteria.
- B. Shop Drawings: Submit shop drawings detailing materials, installation methods, and relationships to adjoining construction for each through penetration firestop system, and each kind of construction condition penetrated and kind of penetrating item. Include firestop design designation of qualified testing and inspecting agency evidencing compliance with requirements for each condition indicated.
  1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through penetration firestop configuration for construction and penetrating items.
  2. Where Project conditions require modification of qualified testing and inspecting agency's illustration to suit a particular through penetration firestop condition, submit illustration approved by firestopping manufacturer's fire protection engineer with modifications marked.
- C. Schedule of Firestopping: Submit complete list, for approval, of penetrations to be sealed, indicating location, fire rating of penetrated assembly, identification of penetration seal to be sealed, fire rating of penetration seal and evidence of acceptable testing.
- D. Quality Control Submittals
  1. Test Reports: Submit product test reports from, and based on tests performed by, a qualified testing and inspecting agency evidencing compliance of firestopping with requirements based on comprehensive testing of current products.
  2. Certificates
    - a. Submit certification by firestopping manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs) and are nontoxic to building occupants.
    - b. Product certificates signed by manufacturers of firestopping products certifying that their products comply with specified requirements.
    - c. Qualification data for firms and persons specified in "Quality Assurance" article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of architects and owners, and other information specified.

#### **1.05 QUALITY ASSURANCE**

- A. Fire Test Response Characteristics: Provide firestopping that complies with the following requirements and those specified under the "System Performance Requirements" article:
  1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, Intertek Testing Agency, or another agency performing testing and



- follow-up inspection services for firestop systems that is acceptable to authorities having jurisdiction.
2. Through penetration firestop systems are identical to those tested per ASTM E814 under conditions where positive furnace pressure differential of at least 0.01-inch of water is maintained at a distance of 0.78-inch below the fill materials surrounding the penetrating items in the test assembly. Provide rated systems complying with the following requirements:
    - a. Through penetration firestop system products bear classification marking of qualified testing and inspecting agency.
    - b. Through penetration firestop systems correspond to those indicated by reference to through penetration firestop system designations listed by UL FRD, by Intertek Testing Agency, or by another qualified testing and inspecting agency.
  3. Fire-resistive joint sealant systems are identical to those tested for fire response characteristics per ASTM E119 under conditions where the positive furnace pressure differential is at least 0.01-inch of water, as measured 0.78-inch from the face exposed to furnace fire. Provide systems complying with the following requirements:
    - a. Fire-Resistance Ratings of Joint Sealants: As indicated by reference to design designations listed by UL FRD or by another qualified testing and inspecting agency.
    - b. Joint sealants, including backing materials, bear classification marking of qualified testing and inspection agency.
- B. Information on Drawings referring to specific design designations of through penetration firestop systems is intended to establish requirements for performance based on conditions that are expected to exist during installation. Any changes in conditions and designated systems require the Architect's prior approval. Submit documentation showing that the performance of proposed substitutions equals or exceeds that of the systems they would replace and are acceptable to authorities having jurisdiction.
- C. Installer Qualifications: Engage an experienced installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having the necessary experience, staff, and training to install manufacturer's products per specified requirements. A manufacturer's willingness to sell its firestopping products to the Contractor or to an installer engaged by the Contractor does not in itself confer qualification on the buyer.
- D. Regulatory Requirements: Conform to CBC for fire resistance ratings and surface burning characteristics.
- E. Provide firestopping products containing no detectable asbestos as determined by the method specified in 40 CFR Part 763, Subpart F, Appendix A, Section 1, "Polarized Light Microscopy".
- F. Coordinating Work: Coordinate construction of openings and penetrating items to ensure that designated through penetration firestop systems are installed per specified requirements.
- G. The District will employ and pay a qualified inspection agency to check installed firestopping systems for compliance with requirements.
- H. Pre-Installation Conference: Prior to the start of work which involves cutting openings in fire wall construction for penetrations, conduct a meeting with installers of such work to identify fire and smoke barriers and required configurations of penetrations and to discuss the proper procedures and time schedule for cutting, patching and sealing penetrations in such assemblies, with emphasis on avoiding unnecessary cutting and patching.

## **PART 2 - PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the manufacturers as defined in the Systems and Applications Schedule in Part 3 of this Section, or accepted.

### **2.02 MATERIALS**

- A. Provide materials classified by UL to provide fire barrier equal to time rating of construction being penetrated.
- B. Provide 100 percent asbestos free materials that comply with applicable codes and have been tested in accordance with UL 1479 or ASTM E814.

## **PART 3 - EXECUTION**

### **3.01 APPLICATION**

- A. General
  - 1. Provide firestopping for conditions specified whether or not firestopping is indicated, and, if indicated, whether such material is designated as insulation, safing, or sealant.
  - 2. Do not install insulation in place of firestopping materials specified in this Section.
- B. Apply materials in accordance with printed instructions of the UL BMD, manufacturer's instructions, or architectural detail as indicated on the Systems and Applications Schedule.
- C. Apply firestopping material in sufficient thickness to achieve rating to uniform density and texture.
- D. Install material at top of fire rated walls and partitions; and at openings in fire rated walls and partitions which contain penetrating sleeves, piping, ductwork, conduit and other items that require firestopping, and at floor transitions.
- E. Install firestop with sufficient pressure to properly fill and seal openings to ensure effective smoke seal.

### **3.02 FIELD QUALITY CONTROL**

- A. Immediately notify the Architect if the specified firestopping systems cannot meet the requirements of the Specification.
- B. All areas of work must be accessible until inspected by the Architect and the Inspector. Correct unacceptable firestops and provide additional inspection to verify compliance with this Specification at no additional cost.

### **3.03 CLEANING**

- A. Clean adjacent surfaces of firestopping materials.
- B. Leave finished work in neat, clean condition with no evidence of spillovers and damage to adjacent surfaces.

**3.04 SYSTEMS AND APPLICATIONS SCHEDULE**

Construction Condition	Manufacturer	Product <sup>1</sup>	Installation Spec
A. Metal pipe or conduit through framed walls	Bio Fireshield	BFS100	Appropriate UL System or Architectural Detail
	or		
	Bio Fireshield	Biostop 500	UL System WL1021
	or		
	3M	CP2SWB+	UL System 147A
	or		
Hilti	FS605	UL System WL1056, 1058	
or			
Hilti	FS601	UL System WL1053, 1060	
or			
Specified Technologies	SpecSeal Series 100 Sealant/Putty	UL System WL1028, 1029	
B. Insulated metal pipe through framed walls	3M	FS195, CP25N/S	UL System 147
	or		
	Bio Fireshield	Biostop 500	UL System WS5015
	or		
Hilti	FS611A	UL System WL5024, 5025, 5026, 5027, 5028, 5029	
or			
Specified Technologies	SpecSeal Series 100 Sealant/Putty	UL System WL5033, 5014, 1049	
C. Plastic pipe through framed walls	3M	FS195, CP25N/S, RCI	UL System 148
	or		
	Bio Fireshield	BFS1-9, BCF Series	Manufacturer's Specification
	or		
Hilti	FS611A	UL System WL2051, 2053	
or			
Specified Technologies	SpecSeal Series 100 Sealant, Wrap Strip or Collar	UL System WL2047, 2046, 2048, 2029	
D. Framed walls	Bio Fireshield	K10	Appropriate UL System or Architectural Detail for 1 hr
	or		
	3M	CS195	UL System 557
	or		
Hilti	FS611A	UL System WL3045, 3046, 3047	
or			
Specified Technologies	SpecSeal Series 100 Sealant	UL System WL4005	
E. Insulated metal pipe through concrete walls	Metacaulk	1000	CAJ 5077
	or		
	BioFireshield	Biostop 500	IMP2CNF
or			
3M	See Mfg	UL System 91, 152	

F. Metal pipe or conduit through concrete floors	Bio Fireshield or Bio Fireshield or 3M or Hilti or Hilti or Specified Technologies	BFS200  BFS100  CP2SWB+  FS-One or CP 606 or CP 601S  FS-One  SpecSeal Series 100 Sealant/Putty	Appropriate UL System or Architectural Detail  UL System CAJ1031  UL System 319  UL System CAJ1150, 1155, 1149  UL System CAJ1184, 1226  UL System CAJ1079, 1142
G. Insulated metal pipe through concrete floors	3M or Bio Fireshield or Hilti or Specified Technologies	See appropriate listing  Biostop 500  FS-One  SpecSeal Series 100 Sealant, Wrap Strip or Mortar	UL System 91, 152, 203  UL System CAJ5015  UL System CAJ5048, 5061, 5069  UL System CAJ5042, 5051
H. Plastic pipe through concrete floors	3M or Bio Fireshield or Hilti or Specified Technologies	CS195, FS195, CP25N/S, CP25S/L  BFS1-9, BCF Series  FS-One CP 680N  SpecSeal Series 100 Sealant, Wrap Strip or Collar	UL System 64  Manufacturer's Specification  UL System FA 2058 UL System FA 2065, 2066 UL System CAJ2031, 2064, 2038, 2045, 2063
I1. Cable tray through concrete floors	Bio Fireshield or 3M or Hilti or Hilti or Specified Technologies	K10  CS195  FS-One  CP 637  SpecSeal Mortar	UL System CAJ4010  UL System 105 or 66  UL System CAJ3095  UL System CAJ4017  UL System CAJ80162
I2. Alternately, terminate cable tray prior to fire wall	Bio Fireshield or Hilti	BFS100  FS611A	Appropriate UL System or Architectural Detail  UL System WL3046, 3047

	or Specified Technologies	SpecSeal Series 100 Sealant or Putty	UL System WL3024, 3025, 8003
J. Telephone, fiber optic, and other small miscellaneous conductors through framed walls	Bio Fireshield or 3M or Hilti or Specified Technologies	BFS100, BFS200  CP25N/S  FS611A  SpecSeal Series 100 Sealant or Putty	UL System 247  UL System 149  UL System WL3046, 3047  UL System WL3024, 3025
K. Noninsulated HVAC ducts	Bio Fireshield or 3M or Hilti or Specified Technologies	BFS100, BFS200  CP25N/S, CP25S/L  FS Series  SpecSeal Series 100 Sealant	Manufacturer's Specifications  Manufacturer's Specifications  Obtain Manufacturer's engineering recommendation  Obtain Manufacturer's engineering recommendation

<sup>1</sup> See UL Listing or Manufacturer's specifications for associated components not listed.

Insulated cable, bus ducts, glass pipe and other penetrations and construction conditions not listed above shall be firestopped with an approved UL system as defined by UL FRD.

**END OF SECTION**

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**SECTION 07 92 00**

**JOINT SEALANTS**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section Includes: Joint sealants and backing systems for the following locations:
  - a. Exterior joints in vertical surfaces as indicated below:
    - 1) Control and expansion joints in cast-in-place concrete.
    - 2) Perimeter joints between concrete and frames of doors and windows.
    - 3) Control and expansion joints in soffit and overhead surfaces.
    - 4) Other joints as indicated.
  - b. Exterior joints in horizontal traffic surfaces as indicated below:
    - 1) Control, expansion and isolation joints in cast-in-place concrete slabs.
    - 2) Other joints as indicated.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- C. Related Sections
  - 1. Section 07 61 00 - Sheet Metal Roofing: Provision of sheet metal roofing.
  - 2. Section 07 62 00 - Sheet Metal Flashing and Trim: Sealing joints related to flashing and sheet metal for roofing.
  - 3. Section 08 90 00 - Louvers and Vents: Provision of louvers and vents.
  - 4. Section 09 90 00 - Painting and Coating: For painting of sealants.

**1.02 REFERENCES**

- A. ASTM - American Society for Testing and Materials
  - 1. C719 - Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants under Cyclic Movement.
  - 2. C919 - Practice for Use of Sealants in Acoustical Applications.
  - 3. C920 - Standard Specification for Elastomeric Joint Sealants
  - 4. C1193 - Guide for Use of Joint Sealants.
  - 5. D1056 - Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.
  - 6. D2240 - Test Method for Rubber Property - Durometer Hardness.

**1.03 SYSTEM DESCRIPTION**

- A. Performance Requirements: Provide joint sealers that have been manufactured to establish and maintain watertight and airtight continuous seals without causing staining or deterioration of joint substrates.

**1.04 SUBMITTALS**

- A. Product Data: Submit product data from manufacturers for each joint sealant product required.
- B. Samples: Submit samples for initial selection purposes in form of manufacturer's standard bead samples, consisting of strips of actual products showing full range of colors available, for each product exposed to view.

- C. Samples for verification purposes of each type and color of joint sealant required. Install joint sealant samples in 1/2-inch wide joints formed between two 6 inch long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- D. Quality Control Submittals
  - 1. Test Reports
    - a. Compatibility and adhesion test reports from elastomeric sealant manufacturer indicating that materials forming joint substrates and joint sealant backings have been tested for compatibility and adhesion with joint sealants. Include sealant manufacturer's interpretation of test results relative to sealant performance and recommendations for primers and substrate preparation needed to obtain adhesion.
    - b. Product test reports for each type of joint sealants indicated, evidencing compliance with requirements specified.
    - c. Preconstruction field test reports indicating which products and joint preparation methods demonstrate acceptable adhesion to joint substrates.
  - 2. Certificates
    - a. Submit certification by joint sealant manufacturers that sealants plus the primers and cleaners required for sealant installations comply with local regulations controlling use of volatile organic compounds.
    - b. Submit certificates from manufacturers of joint sealants attesting that their products comply with specification requirements and are suitable for the use indicated.

#### **1.05 QUALITY ASSURANCE**

- A. Installer Qualifications: Engage an experienced installer who has completed joint sealant applications similar in material, design and extent to that indicated for this Project that have resulted in construction with a record of successful in-service performance.
- B. Preconstruction Compatibility and Adhesion Testing: Submit to joint sealant manufacturers samples of materials that will contact or affect joint sealants for compatibility and adhesion testing as indicated below:
  - 1. Use test methods standard with manufacturer to determine if priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
  - 2. Submit not less than 9 pieces of each type of material, including joint substrates, shims, joint sealant backings, secondary seals and miscellaneous materials.
  - 3. Schedule sufficient time for testing and analysis of results to prevent delay in the progress of the Work.
  - 4. Investigate materials failing compatibility or adhesion tests and obtain joint sealant manufacturer's written recommendations for corrective measures, including use of specially formulated primers.
  - 5. Testing will not be required when joint sealant manufacturer is able to submit joint preparation data required above that are acceptable to the Architect and are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.
- C. Product Testing: Provide comprehensive test data for each type of joint sealant based on tests conducted by a qualified independent testing laboratory on current product formulations within a 24 month period preceding date of Contractor's submittal of test results to the Architect.
  - 1. Test elastomeric sealants for compliance with requirements specified by reference to ASTM C920. Include test results for hardness, stain resistance, adhesion and cohesion under cyclic movement (per ASTM C719), low-temperature flexibility, modulus of elasticity at 100 percent strain, effects of heat aging and effects of accelerated weathering.



- D. Preconstruction Field Testing: Prior to installation of joint sealants, field-test their adhesion to joint substrates as follows:
1. Locate test joints where indicated or, if not indicated, as directed by the Architect.
  2. Conduct field tests for each application indicated below:
    - a. Each type of elastomeric sealant and joint substrate indicated.
    - b. Each type of non-elastomeric sealant and joint substrate indicated.
  3. Notify the Architect 1 week in advance of the dates and times when mock-ups will be erected.
  4. Test Method: Test joint sealants by hand pull method described below:
    - a. Install joint sealants in 60 inch joint lengths using same materials and methods for joint preparation and joint sealant installation required for completed Work. Allow sealants to cure fully before testing.
    - b. Make knife cuts horizontally from one side of joint to the other followed by 2 vertical cuts approximately 2 inches long at side of joint and meeting horizontal cut at top of 2 inch cuts. Place a mark 1 inch from top of 2 inch piece.
    - c. Use fingers to grasp 2 inch piece of sealant just above 1 inch mark; pull firmly down at a 90 degree angle or more while holding a ruler along side of sealant. Pull sealant out of joint to the distance recommended by sealant manufacturer for testing adhesive capability, but not less than that equaling specified maximum movement capability in extension; hold this position for 10 seconds.
  5. Report whether or not sealant in joint connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate.
  6. Evaluation of Field Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Acceptance at Site: Deliver materials to the Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time and mixing instructions for multicomponent materials.
- B. Storage and Protection: Store and handle materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants or other causes.

#### **1.07 PROJECT CONDITIONS**

- A. Environmental Conditions: Do not proceed with installation of joint sealants under the following conditions:
  1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer.
  2. When joint substrates are wet.
- B. Joint Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than allowed by joint sealant manufacturer for application indicated.
- C. Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

#### **1.08 SEQUENCING AND SCHEDULING**

- A. Sequence installation of joint sealants to occur not less than 21 nor more than 30 days after completion of waterproofing, unless otherwise indicated.

## **PART 2 - PRODUCTS**

### **2.01 MATERIALS**

- A. General Requirements
  - 1. Provide joint sealers compatible with one another and with substrates.
  - 2. Manufacturer's standard color range shall permit matching sealants to color of contacting surfaces.
  - 3. Refer to Part 3 of this Section for Schedule of typical applications.
  
- B. Sealants and Caulks
  - 1. Type A - One Part Neutral Cure Silicone Sealant
    - a. ASTM C920, non-sag, one part, low modulus, elastomeric sealant.
    - b. Color: As selected by the Architect.
    - c. Manufacturer: Dow-Corning, "790"; Tremco, "Spectrum 1", or equal.
  - 2. Type B - Polyurethane Sealant, Two Component
    - a. ASTM C920, Type M; Grade P; Class 25; Use T having minimum ASTM D2240 Shore A hardness of 30 plus or minus 5.
    - b. Color: As selected by the Architect.
    - c. Manufacturer: Sika Corp., "Sikaflex 2cSL"; Sonneborn Building Products Division, "Sonolastic SL2", or equal.

### **2.02 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: ASTM D1056 round, closed cell polyethylene foam rod; oversized 30 to 50 percent larger than joint width as recommended by manufacturer of sealant material.
  
- D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

## **PART 3 - EXECUTION**

### **3.01 EXAMINATION**

- A. Examine joints indicated to receive joint sealants, with installer present, for compliance with requirements for joint configuration, installation tolerances and other conditions affecting joint sealant performance.
  
- B. Do not proceed with installation of joint sealants until unsatisfactory conditions have been corrected.

### **3.02 PREPARATION**

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with recommendations of joint sealant manufacturer and the following requirements:
  - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt and frost.

2. Clean concrete, unglazed surfaces of ceramic tile and similar porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.
  3. Remove laitance and form release agents from concrete.
  4. Clean metal, glass, glazed surfaces of ceramic tile and other nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates or leave residues capable of interfering with adhesion of joint sealants.
- B. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealant manufacturer based on preconstruction joint sealant substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's recommendations. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

### **3.03 INSTALLATION OF JOINT SEALANTS**

- A. General: Comply with joint sealant manufacturer's printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations of ASTM C1193 for use of joint sealants as applicable to materials, applications and conditions indicated.
- C. Acoustical Sealant Application Standard: Comply with recommendations of ASTM C919 for use of joint sealants in acoustical applications as applicable to materials, applications and conditions indicated.
- D. Installation of Sealant Joint Backings: Install sealant joint backings to comply with the following requirements:
1. Install joint fillers of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
    - a. Do not leave gaps between ends of joint fillers.
    - b. Do not stretch, twist, puncture or tear joint fillers.
    - c. Remove absorbent joint fillers that have become wet prior to sealant application and replace with dry material.
  2. Install bond breaker tape between sealants where backer rods are not used between sealants and joint fillers or back of joints.
- E. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration and providing uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at the same time sealant backings are installed.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.
1. Provide concave joint configuration per Figure 5A in ASTM C1193, unless otherwise indicated.

**3.04 CLEANING**

- A. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

**3.05 PROTECTION**

- A. Protect joint sealants during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so that and installations with repaired areas are indistinguishable from original work.

**3.06 SCHEDULE**

- A. Type A, Non-Sag
  - 1. Between metal and concrete or mortar.
  - 2. Exterior perimeter joints between cast-in-place concrete and frames of doors and windows.
  - 3. Vertical joints at concrete masonry units.
- B. Type B
  - 1. Exterior control, expansion, and isolation joints in cast-in-place concrete slabs.
  - 2. Exterior wood to wood and wood to galvanized metal and aluminum with primer.

**END OF SECTION**

## SECTION 08 11 15

### STEEL DOORS AND FRAMES

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. Section Includes
  - 1. Non-fire resistance rated flush steel doors with louvers and screens.
  - 2. Non-fire resistance rated steel frames.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- C. Related Sections
  - 1. Section 08 71 00 - Door Hardware: Provision of door hardware.
  - 2. Section 09 90 00 - Painting and Coating: For field painting of primed doors and frames.

##### 1.02 REFERENCES

- A. ASTM - American Society for Testing and Materials
  - 1. A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
  - 2. A568 - Standard Specification for General Requirements for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled.
  - 3. A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - 4. A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
  - 5. A1011 - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
- B. DHI - Door and Hardware Institute
  - 1. A115 Series - Steel Door Preparation Standards.
- C. SDI - Steel Door Institute
  - 1. 105 - Recommended Erection Instructions for Steel Frames.
  - 2. 112 - Galvanized Standard Steel Doors and Frames.
  - 3. 117 - Manufacturing Tolerances Standard Steel Doors and Frames.
  - 4. A250.8 - Recommended Specifications for Standard Steel Doors and Frames.

##### 1.03 SUBMITTALS

- A. Product Data: Submit product data for each type of door and frame specified, including details of construction, materials, dimensions, hardware preparation, core, label compliance, sound ratings, profiles, and finishes.
- B. Shop Drawings: Submit shop drawings showing fabrication and installation of standard steel doors and frames referenced to the Architect's door mark and hardware group. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and installation requirements of door and frame hardware and reinforcements, and details of joints and connections. Show anchorage and accessory items.
  - 1. Provide schedule of doors and frames using same reference numbers for details and openings as those on the Drawings.

## **PART 2 - PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Acceptable Manufacturers: Republic Builders Products; Steelcraft Manufacturing Co.; Door Components, Inc.; Kewanee; Stiles Hollow Metal; Curries, or equal.

### **2.02 MATERIALS**

- A. Hot-Rolled Steel Sheets and Strip: Commercial quality carbon steel, pickled and oiled, complying with ASTM A568 and ASTM 1011.
- B. Cold-Rolled Steel Sheets: Commercial quality carbon steel, complying with ASTM A568.
- C. Galvanized Steel Sheets: Zinc-coated carbon steel sheets of commercial quality, hot dipped galvanized in accordance with ASTM A653 and ASTM A924 with A60 or G60 coating designation, mill phosphatized.
- D. Supports and Anchors: Fabricate of not less than 18 gauge sheet steel; galvanized where used with galvanized frames.
- E. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where items are to be built in at exterior walls, hot-dip galvanize in compliance with ASTM A153, Class C or D as applicable.
- F. Shop Applied Paint: Apply after fabrication.
  - 1. Primer: Rust-inhibitive enamel or paint, either air-drying or baking, suitable as a base for specified finish paints.
- G. Finish: As specified in Section 09 90 00.

### **2.03 DOORS**

- A. Provide metal doors of SDI grades and models specified below or as indicated on the Drawings or schedules.
  - 1. Exterior Doors: SDI A250.8, Grade III, extra heavy-duty, Model 2, seamless design, minimum 0.0635-inch thick, galvanized steel faces.
  - 2. Door Louvers: Provide sightproof stationary louvers for exterior doors where indicated, constructed of inverted V-shaped or Y-shaped blades formed of 24 gauge cold-rolled steel set into minimum 20 gauge steel frame. Provide with 1/4-inch steel mesh insect screen.
- B. Door Cores
  - 1. Core Stiffeners: Vertical steel stiffeners or steel channel grid.
  - 2. Core Filler: Sound deadening mineral composition, incombustible, moisture resistant, chemically inert containing no HCFCs, in accordance with reviewed manufacturer's recommendations.
- C. Frames
  - 1. Provide metal frames for doors of types and styles as indicated on the Drawings and schedules. Conceal fastenings, unless otherwise indicated.
    - a. Exterior: Fabricate fully welded frames of minimum 14 gauge galvanized steel.
  - 2. Door Silencers: Except on weatherstripped and smoke gasketed frames, drill stops to receive 3 silencers on strike jambs of single door frames and 2 silencers on heads of double door frames.

## **2.04 FABRICATION**

- A. Fabricate steel door and frame units to be rigid, neat in appearance and free from defects, warp or buckle. Wherever practicable, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory-assembled before shipment, to assure proper assembly at Project site. Comply with SDI A250.8 requirements.
  - 1. Internal Construction: Manufacturer's standard vertical steel stiffeners or unitized steel grid with internal sound deadener on inside of face sheets where appropriate in accordance with SDI standards.
  - 2. Clearances: Not more than 1/8-inch at jambs and heads except between non-fire resistance rated pairs of doors not more than 1/4-inch. Not more than 3/4-inch at bottom.
- B. Tolerances: Comply with SDI 117.
- C. Fabricate exterior doors, panels, and frames from galvanized sheet steel in accordance with SDI 112. Close top and bottom edges of exterior doors as integral part of door construction, fully sealed, bonded, and flush.
- D. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat or oval heads for exposed screws and bolts.
- E. Hardware Preparation: Prepare doors and frames to receive mortised and concealed hardware in accordance with final Door Hardware Schedule and templates provided by hardware supplier. Comply with applicable requirements of DHI A115 Series Specifications for door and frame preparation for hardware.
  - 1. For concealed overhead door closers, provide space, cutouts, reinforcing, and provisions for fastening in top rail of doors or head of frames, as applicable.
- F. Reinforce doors and frames to receive surface applied hardware. Drilling and tapping for surface applied hardware may be done at Project site.
- G. Locate hardware as indicated on final shop drawings or, if not indicated, in accordance with DHI.
- H. Shop Painting: Clean, treat, and paint exposed surfaces of steel door and frame units, including galvanized surfaces.
  - 1. Clean steel surfaces of mill scale, rust, oil, grease, dirt, and other foreign materials before application of paint.
  - 2. Apply shop coat of prime paint of even consistency to provide a uniformly finished surface ready to receive finish paint. Ensure primer is compatible with final finish paint.
- I. Glazing Stops: Minimum 20 gauge steel.
  - 1. Provide non-removable stops on outside of exterior doors for louvers and other panels in doors.
  - 2. Provide screw applied removable glazing beads on inside of glass, louvers, and other panels in doors.

## **2.05 FINISHES**

- A. Finish Painting: As specified in Section 09 90 00.

### **PART 3 - EXECUTION**

#### **3.01 INSTALLATION**

- A. General: Install steel doors, frames, and accessories in accordance with final shop drawings, manufacturer's data, and as herein specified.
- B. Placing Frames: Comply with provisions of SDI 105, unless otherwise indicated.
  - 1. Except for frames located at existing concrete, masonry, or drywall installations, place frames prior to construction of enclosing walls and ceilings. Set frames accurately in position, plumbed, aligned and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders leaving surfaces smooth and undamaged.
- C. Door Installation: Fit hollow metal doors accurately in frames, within clearances specified in SDI A250.8.

#### **3.02 ADJUST AND CLEAN**

- A. Prime Coat Touch-Up: Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touch-up of compatible air-drying primer.
- B. Final Adjustments: Check and readjust operating hardware items, leaving steel doors and frames undamaged and in complete and proper operating condition.

**END OF SECTION**



**SECTION 08 15 00**

**PLASTIC DOORS**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section Includes: Exterior flush fiberglass reinforced plastic (FRP) door and aluminum door frame.
- B. Products Installed but not Furnished Under this Section
  - 1. Section 08 71 00 - Door Hardware: Furnishing of finish hardware.
- C. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

**1.02 REFERENCES**

- A. ANSI - American National Standards Institute
  - 1. 250.4 - Test Procedures for and Acceptance Criteria for Physical Evidence for Steel Doors and Reinforcement.
- B. AAMA - American Architectural Manufacturers Association
  - 1. 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.
- C. ASTM - American Society for Testing and Materials
  - 1. B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus.
  - 2. B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
  - 3. B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
  - 4. D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.
  - 5. D570 - Standard Test Method for Water Absorption of Plastics.
  - 6. D638 - Standard Test Method for Tensile Properties of Plastics.
  - 7. D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
  - 8. D2583 - Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.
  - 9. D5420 - Standard Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Striker Impacted by a Falling Weight (Gardner Impact).
  - 10. D6670 - Standard Practice for Full-Scale Chamber Determination of Volatile Organic Emissions from Indoor Materials/Products.
  - 11. E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
  - 12. E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
  - 13. E283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
  - 14. E330 - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
  - 15. E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
  - 16. F476 - Standard Test Methods for Security of Swinging Door Assemblies.
- D. GREENGUARD Environmental Institute

- E. NWWDA - National Wood Window and Door Association (Now WDMA - Window and Door Manufacturers Association)
  - 1. T.M. 7-90 - Cycle-Slam Test Method.
- F. SMCCCD - San Mateo County Community College District

### 1.03 SYSTEM DESCRIPTION

- A. Performance Requirements
  - 1. General: Provide door assemblies that have been designed and fabricated to comply with specified performance requirements, as demonstrated by testing manufacturer's corresponding standard systems.
  - 2. Air Infiltration: For a single door 3 feet-0 inches by 7 feet-0 inches, test specimen shall be tested in accordance with ASTM E283 at pressure differential of 6.24 psf. Door shall not exceed 0.90 cfm per linear foot of perimeter crack.
  - 3. Water Resistance: For a single door 3 feet-0 inches by 7 feet-0 inches, test specimen shall be tested in accordance with ASTM E331 at pressure differential of 7.50 psf. Door shall not have water leakage.
  - 4. Indoor Air Quality: Testing in accordance with ASTM D6670 and GREENGUARD Environmental Institute Certified, including GREENGUARD for Children and Schools Certification.
  - 5. Hurricane Test Standards, Single Door with Single-Point Latching
    - a. Uniform Static Load, ASTM E330: Plus or minus 75 pounds per square foot.
    - b. Forced Entry Test, 300 Pound Load Applied, CBC 3603.2 (b)(5): Passed.
    - c. Cyclic Load Test, CBC PA 203: Plus or minus 53 pounds per square foot.
    - d. Large Missile Impact Test, CBC PA 201: Passed.
  - 6. Swinging Door Cycle Test, Doors and Frames, ANSI A250.4: Minimum of 25,000,000 cycles.
  - 7. Cycle Slam Test Method, NWWDA T.M. 7-90: Minimum 5,000,000 Cycles.
  - 8. Swinging Security Door Assembly, Doors and Frames, ASTM F476: Grade 40.
  - 9. Salt Spray, Exterior Doors and Frames, ASTM B117: Minimum of 500 hours.
  - 10. Sound Transmission, Exterior Doors, STC, ASTM E90: Minimum of 25.
  - 11. Thermal Transmission, Exterior Doors, U-Value, AAMA 1503: Maximum of 0.29 BTU/hr x sf x degrees Fahrenheit; minimum 55 CRF value.
  - 12. Surface Burning Characteristics, FRP Doors and Panels, ASTM E84
    - a. Flame Spread: Maximum of 200, Class C.
    - b. Smoke Developed: Maximum of 450, Class C.
  - 13. Surface Burning Characteristics, Class A Option on Interior Faces of FRP Exterior Panels and Both Faces of FRP Interior Panels, ASTM E84
    - a. Flame Spread: Maximum of 25.
    - b. Smoke Developed: Maximum of 450.
  - 14. Impact Strength, FRP Doors and Panels, Nominal Value, ASTM D256: 15.0 foot-pounds per inch of notch.
  - 15. Tensile Strength, FRP Doors and Panels, Nominal Value, ASTM D638: 14,000 psi.
  - 16. Flexural Strength, FRP Doors and Panels, Nominal Value, ASTM D790: 21,000 psi.
  - 17. Water Absorption, FRP Doors and Panels, Nominal Value, ASTM D570: 0.20 percent after 24 hours.
  - 18. Indentation Hardness, FRP Doors and Panels, Nominal Value, ASTM D2583: 55.
  - 19. Gardner Impact Strength, FRP Doors and Panels, Nominal Value, ASTM D5420: 120 in-lb.

### 1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's product data, including description of materials, components, fabrication, finishes, and installation.

- B. Shop Drawings: Submit manufacturer's shop drawings, including elevations, sections, and details, indicating dimensions, tolerances, materials, fabrication, doors, panels, framing, hardware schedule, and finish.
- C. Samples
  - 1. Door: Submit manufacturer's sample of door showing face sheets, core, framing, and finish.
  - 2. Color: Submit manufacturer's samples of standard colors of doors and frames.
- D. Test Reports: Submit certified test reports from qualified independent testing agency indicating doors comply with specified performance requirements.
- E. Manufacturer's Project References: Submit list of successfully completed projects including project name and location, name of architect, and type and quantity of doors manufactured.
- F. Maintenance Manual: Submit manufacturer's maintenance and cleaning instructions for doors, including maintenance and operating instructions for hardware.
- G. Provide GREENGUARD for Children and Schools Certification.

#### **1.05 QUALITY ASSURANCE**

- A. Manufacturer's Qualifications
  - 1. Continuously engaged in manufacturing of doors of similar type to that specified, with a minimum of 25 years successful experience.
  - 2. Door and frame components from same manufacturer.
  - 3. Evidence of a compliant documented quality management system.

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying opening door mark and manufacturer.
- B. Storage: Store materials in clean, dry area indoors in accordance with manufacturer's instructions.
- C. Handling: Protect materials and finish from damage during handling and installation.

#### **1.07 WARRANTY**

- A. Warrant doors, frames, and factory hardware against failure in materials and workmanship, including excessive deflection, faulty operation, defects in hardware installation, and deterioration of finish or construction in excess of normal weathering.
- B. Warranty Period: 10 years starting on date of shipment. In addition, provide a lifetime warranty covering: failure of corner joinery, core deterioration, delamination or bubbling of door skin.

### **PART 2 - PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Acceptable Manufacturer: Special-Lite, Inc., "SL-17 Flush Doors with SpecLite3 Fiberglass Reinforced Polyester (FRP) Face Sheets", or equal.

## 2.02 MATERIALS

- A. Aluminum Members
  - 1. Extrusions: ASTM B221.
  - 2. Sheet and Plate: ASTM B209.
  - 3. Alloy and Temper: As required by manufacturer for strength, corrosion resistance, application of required finish, and control of color.
- B. Fasteners
  - 1. Material: Aluminum, 18-8 stainless steel, or other noncorrosive metal.
  - 2. Compatibility: Compatible with items to be fastened.
  - 3. Exposed Fasteners: Screws with finish matching items to be fastened.

## 2.03 FRP FLUSH DOORS

- A. Construction
  - 1. Door Thickness: 1-3/4 inches.
  - 2. Stiles and Rails: Aluminum alloy 6063-T5, minimum of 2-5/16-inch depth.
  - 3. Corners: Mitered.
  - 4. Provide joinery of 3/8-inch diameter full-width tie rods through extruded splines top and bottom as standard tubular shaped stiles and rails reinforced to accept hardware as specified.
  - 5. Securing Internal Door Extrusions: 3/16-inch angle blocks and locking hex nuts for joinery. Welds, glue, or other methods are not acceptable.
  - 6. Furnish extruded stiles and rails with integral reglets to accept face sheets. Lock face sheets into place to permit flush appearance.
  - 7. Rail caps or other face sheet capture methods are not acceptable.
  - 8. Extrude top and bottom rail legs for interlocking continuous weather bar.
  - 9. Meeting Stiles: Pile brush weatherseals. Extrude meeting stile to include integral pocket to accept pile brush weatherseals.
  - 10. Bottom of Door: Install bottom weather bar with nylon brush weatherstripping into extruded interlocking edge of bottom rail.
  - 11. Glue: Use of glue to bond sheet to core or extrusions is not acceptable.
- B. Face Sheet
  - 1. Material: SpecLite3 FRP, 0.120-inch thickness, finish color throughout.
  - 2. Protective coating: Abuse-resistant engineered surface with UV inhibitors.
  - 3. Texture: Pebble.
  - 4. Color: As selected by the Architect from manufacturer's standard range, in accordance with SMCCCD Design Standards.
  - 5. Adhesion: The use of glue to bond face sheet to foam core is prohibited.

- C. Core
  - 1. Material: Poured-in-place polyurethane foam.
  - 2. Density: Minimum of 5 pounds per cubic foot.
  - 3. R-Value: Minimum of 9.

## 2.04 FRAMES

- A. Aluminum Frames
  - 1. Size and Type: As indicated on the Drawings.
  - 2. Materials: Aluminum Alloy 6063-T5, 1/8-inch minimum wall thickness.
  - 3. Applied Door Stops: 0.625-inch high, with screws and weatherstripping. Door stop shall incorporate pressure gasketing for weathering seal. Counterpunch fastener holes in door stop to preserve full metal thickness under fastener head.

4. Frame Members: Box type with 4 enclosed sides. Open-back framing is not acceptable.
5. Caulking: Caulk joints before assembling frame members.
6. Joints: Secure joints with fasteners. Provide hairline butt joint appearance.
7. Field Fabrication: Field fabrication of framing using stick material is not acceptable.
8. Applied Stops: Applied stops shall incorporate pressure gasketing for weathering seal. Reinforce with solid bar stock fill for frame hardware attachments.
9. Hardware: Premachine and reinforce frame members for hardware in accordance with manufacturer's standards and hardware schedule. Factory install hardware.
10. Anchors
  - a. Anchors appropriate for wall conditions to anchor framing to wall materials.
  - b. Door Jamb and Header Mounting Holes: Maximum of 24-inch centers.
  - c. Secure head and sill members of transom, side lites, and similar conditions.

## **2.05 FABRICATION**

- A. Sizes and Profiles: Required sizes for door and frame units, and profile requirements shall be as indicated on the Drawings.
- B. Coordination of Fabrication: Field measure before fabrication and show recorded measurements on shop drawings.
- C. Assembly
  1. Complete cutting, fitting, forming, drilling, and grinding of metal before assembly.
  2. Remove burrs from cut edges.
- D. Welding: Welding of doors or frames is not acceptable.
- E. Fit
  1. Maintain continuity of line and accurate relation of planes and angles.
  2. Secure attachments and support at mechanical joints with hairline fit at contacting members.
- F. Premachine doors in accordance with templates from specified hardware manufacturers and hardware schedule.
- G. Factory install hinges, locksets and panics.

## **PART 3 - EXECUTION**

### **3.01 EXAMINATION**

- A. Examine areas to receive doors. Notify Architect of conditions that would adversely affect installation or subsequent use. Do not proceed with installation until unsatisfactory conditions are corrected.

### **3.02 PREPARATION**

- A. Ensure openings to receive frames are plumb, level, square, and in tolerance.

### **3.03 INSTALLATION**

- A. Install doors in accordance with manufacturer's instructions.
- B. Install doors plumb, level, square, true to line, and without warp or rack.
- C. Anchor frames securely in place.

- D. Separate aluminum from other metal surfaces with bituminous coatings or other means approved by Architect.
- E. Set thresholds in bed of mastic and backseal.
- F. Install exterior doors to be weathertight in closed position.
- G. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.
- H. Remove and replace damaged components that cannot be successfully repaired as determined by Architect.

**3.04 FIELD QUALITY CONTROL**

- A. Manufacturer's Field Services: Manufacturer's representative shall provide technical assistance and guidance for installation of doors.

**3.05 ADJUSTING**

- A. Adjust doors, hinges, and locksets for smooth operation without binding.

**3.06 CLEANING**

- A. Clean doors promptly after installation in accordance with manufacturer's instructions.
- B. Do not use harsh cleaning materials or methods that would damage finish.

**3.07 PROTECTION**

- A. Protect installed doors to ensure that, except for normal weathering, doors will be without damage or deterioration at time of substantial completion.

**END OF SECTION**

**SECTION 08 71 00**

**DOOR HARDWARE**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section Includes: Items known commercially as finish or door hardware that are required for swing, sliding, and folding doors, except special types of unique hardware specified in the same sections as the doors and door frames on which they are installed. This Section includes the following, but is not necessarily limited to:
  - 1. Door hardware.
  - 2. Gate hardware.
  - 3. Access control devices.
  - 4. Thresholds, gasketing, and weather-stripping.
  - 5. Door silencers or mutes.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- C. Related Sections
  - 1. Section 05 50 00 - Metal Fabrications: Provision of tubular steel gates in chain link fencing.
  - 2. Section 08 11 15 - Steel Doors and Frames: Provision of steel doors and frames.
  - 3. Section 08 15 00 - Plastic Doors: Provision of plastic doors.
  - 4. Section 28 13 00 - Access Control and Alarm Monitoring System (ACAMS): Provision of access control and alarm monitoring system.
  - 5. Section 32 31 00 - Fences and Gates: Provision of swing gates.

**1.02 REFERENCES**

- A. ADA - Americans with Disabilities Act
  - 1. AG - Accessibility Guidelines for Buildings and Facilities.
- B. ANSI - American National Standards Institute
  - 1. A115.18 - Specifications for Standard Steel Doors and Steel Frames Preparation for Bored Locks.
  - 2. A156.3 - Exit Devices.
  - 3. A156.4 - Door Controls - Closers.
- C. ASTM - American Society for Testing and Materials
  - 1. E283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- D. BHMA - Builders' Hardware Manufacturers Association
  - 1. A156.3 - Exit Devices.
  - 2. A156.4 - Door Controls - Closers.
- E. CBC - California Building Code, 2007 Edition
- F. CCR - California Code of Regulations
  - 1. Title 24, Part 2, California State Accessibility Standards.
- G. DHI - Door and Hardware Institute
  - 1. A115.18 - Specifications for Standard Steel Doors and Steel Frames Preparation for Bored Locks.

- H. Intertek Testing Agency
- I. NFPA - National Fire Protection Association
  - 1. 80 - Standard for Fire Doors and Fire Windows.
- J. UBC - Uniform Building Code
  - 1. 7.2 - Fire Tests of Door Assemblies.
  - 2. 10-4 - Panic Hardware.
- K. UL - Underwriters Laboratories Inc.
  - 1. 10C - Positive Pressure Fire Tests of Door Assemblies.

### **1.03 SUBMITTALS AND SUBSTITUTIONS**

- A. Submit product data (catalog cuts) including manufacturers' technical product information for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
- B. Submit 6 copies of schedule organized vertically into "Hardware Sets" with index of doors and headings, indicating complete designations of every item required for each door or opening. Include following information:
  - 1. Type, style, function, size and finish of each hardware item.
  - 2. Name, part number and manufacturer of each item.
  - 3. Fastenings and other pertinent information.
  - 4. Location of hardware set coordinated with floor plans and door schedule.
  - 5. Explanation of all abbreviations, symbols and codes contained in schedule.
  - 6. Mounting locations for hardware.
  - 7. Door and frame sizes and materials.
  - 8. List of manufacturers used and their nearest representative with address and phone number.
- C. Make substitution requests in accordance with Division 1. Substitution requests must be made prior to bid date. Include product data and indicate benefit to the project. Furnish samples of any proposed substitution.
- D. Templates for doors, frames, and other work specified to be factory prepared for the installation of door hardware. Check shop drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- E. Furnish as-built/as-installed schedule with close-out documents, wiring/riser diagrams, manufacturers' installation, adjustment and maintenance information.

### **1.04 QUALITY ASSURANCE**

- A. Obtain each type of hardware (latch and lock sets, hinges, closers, exit devices, etc.) from a single manufacturer.
- B. Supplier Qualifications: A recognized architectural door hardware supplier, with warehousing facilities in the project's vicinity, that has a record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this project and that employs an experienced architectural hardware consultant (AHC) who is available to the District, Architect, and Contractor, at reasonable times during the course of the Work, for consultation.
  - 1. Responsible for detailing, scheduling, and ordering of finish hardware.
  - 2. Meet with the District to finalize keying requirements and to obtain final instructions in writing.
  - 3. Stock parts for products supplied and be capable of repairing and replacing hardware items found defective within warranty periods.



- C. Hardware Installer: Company specializing in the installation of commercial door hardware with 5 years documented experience.
- D. Fire-Rated Openings: Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and tested by UL or Intertek Testing Agency for given type/size opening and degree of label. Provide proper latching hardware, door closers, approved-bearing hinges and seals whether listed in the Hardware Schedule or not.
  - 1. Where emergency exit devices are required on fire-rated doors, (with supplementary marking on doors' UL labels indicating "Fire Door to be Equipped with Fire Exit Hardware") provide UL label on exit devices indicating "Fire Exit Hardware".
- E. Exit Doors: Operable from inside with single motion without the use of a key or special knowledge or effort.
- F. Pre-Installation Conference
  - 1. Convene a pre-installation conference at least one week prior to beginning work of this section.
  - 2. Attendance: Architect, Construction Manager, Contractor, Security Contractor, Hardware Supplier, Installer, Key District Personnel, and Project Inspector.
  - 3. Agenda: Review hardware schedule, products, installation procedures and coordination required with related work. Review District's keying standards.

#### **1.05 DELIVERY, STORAGE AND HANDLING**

- A. Coordinate delivery of packaged hardware items to the appropriate locations (shop or field) for installation.
- B. Hardware items shall be individually packaged in manufacturers' original containers, complete with proper fasteners. Clearly mark packages on outside to indicate contents and locations in hardware schedule and in work.
- C. Provide locked storage area for hardware, protect from moisture, sunlight, paint, chemicals, etc.
- D. Inventory door hardware jointly with representatives of hardware supplier and hardware installer until each is satisfied that count is correct.
- E. Ship all permanent keys, cylinders and/or cores directly from lock manufacturer to the District.

#### **1.06 WARRANTY**

- A. Provide warranties of respective manufacturers' regular terms of sale from day of final acceptance as follows:
  - 1. Locksets: 7 years.
  - 2. Closers: 10 years, except electronic closers shall be 2 years.
  - 3. Exit Devices: 3 years.
  - 4. All Other Hardware: 2 years.

#### **1.07 MAINTENANCE**

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for the District's continued adjustment, maintenance, and removal and replacement of door hardware.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

<u>Item</u>	<u>Manufacturer</u>	<u>Acceptable Substitutes</u>
A. Hinges	Ives/Hager	Matches existing District Standard
B. Locks, Latches and Cylinders	Schlage	Matches existing District Standard
C. Exit Devices	Von Duprin	Matches existing District Standard
D. Closers	LCN	Matches existing District Standard
E. Push, Pulls and Protection Plates	Ives	Matches existing District Standard
F. Flush Bolts	Ives	Matches existing District Standard
G. Dust Proof Strikes	Ives	Matches existing District Standard
H. Coordinators	Ives	Matches existing District Standard
I. Stops	Ives	Matches existing District Standard
J. Thresholds	National Guard	Pemko
K. Seals and Bottoms	National Guard	Pemko

### 2.02 MATERIALS

- A. Continuous Hinges: As manufactured by Select Products Limited. UL rated as required.
- B. Heavy Duty Cylindrical Locks and Latches: Schlage "ND" Series as scheduled with "Sparta" design fastened with through-bolts.
  - 1. Chassis: Cylindrical design, zinc plated for corrosion-resistance.
  - 2. Latch Bolt: Steel, 1/2-inch throw, deadlocking on keyed and exterior functions; 3/4-inch throw anti-friction latch available for pairs of fire doors.
  - 3. Faceplate: Brass, bronze or stainless steel; 1-1/8 inches by 2-1/4 inches square corner, beveled.
  - 4. Lever Trim: Accessible design, pressure cast zinc, plated to match finish symbols; roses: brass.
  - 5. Locks shall be of such construction that when locked, the door may be opened from within by using lever and without the use of a key or special knowledge.
  - 6. Vandlgard Function: 7 year warranty, outside lever is disengaged when in the locked mode.
  - 7. Rosettes: Minimum 3-7/16 inches diameter for coverage of ANSI/DHI A115.18, 1994 door preparation, through-bolt lugs on both spring cages to fully engage this pattern.
  - 8. Springs: Full compression type.
  - 9. Strikes: 16 gauge curved steel, bronze or brass with 1-inch deep box construction, lips of sufficient length to clear trim and protect clothing.
- C. Exit Devices: Von Duprin as scheduled with push-through pad design, no exposed touch bar fasteners, no exposed cavities when operated.
  - 1. Provide certificate by independent testing laboratory that device has completed over 1,000,000 cycles and can still meet ANSI/BHMA A156.3 - 1994 standards.
  - 2. All internal parts shall be of cold-rolled steel with zinc dichromate coating.
  - 3. Mechanism case shall have an average thickness of .140-inch.
  - 4. Compression spring engineering.

5. Non-handed basic device design with center case interchangeable with all functions.
  6. All devices shall have quiet return fluid dampeners.
  7. All latchbolts shall be deadlocking with 3/4-inch throw and have a self-lubricating coating to reduce friction and wear.
  8. Device shall bear UL label for fire and or panic as may be required.
  9. All surface strikes shall be roller type and utilize a plate underneath to prevent movement.
  10. Lever Trim: "Breakaway" design, forged brass or bronze escutcheon with a minimum of .130-inch thickness, match lockset lever design.
  11. Removable Mullions: Removable with single turn of building key. Securely reinstalled without need for key.
  12. Furnish glass bead kits for vision lites where required.
  13. All Exit Devices to be sex-bolted to the doors.
  14. Panic Hardware shall comply with UBC Standard 10-4 and shall be mounted between 30 inches and 44 inches above the finished floor surface. The unlatching force shall not exceed 15 pounds applied in the direction of travel. Panic hardware shall comply with CBC Section 1003.3.1.9.
- D. Closers: LCN as scheduled. Place closers inside building, stairs, room, etc.
1. Door closer cylinders shall be of high strength cast iron construction with double heat treated pinion shaft to provide low wear operating capabilities of internal parts throughout the life of the installation. All door closers shall be tested to ANSI/BHMA A156.4 test requirements by a BHMA certified testing laboratory. A written certification showing successful completion of a minimum of 10,000,000 cycles must be provided.
  2. All door closers shall be fully hydraulic and have full rack and pinion action with a shaft diameter of a minimum of 11/16-inch and piston diameter of 1 inch to ensure longevity and durability under all closer applications.
  3. All parallel arm closers shall incorporate one piece solid forged steel arms with bronze bushings; 1-9/16 inch steel stud shoulder bolts, shall be incorporated in regular arms, hold-open arms, arms with hold open and stop built in. All other closers to have forged steel main arms for strength, durability, and aesthetics for versatility of trim accommodation, high strength and long life.
  4. All parallel arm closers so detailed shall provide advanced backcheck for doors subject to severe abuse or extreme wind conditions. This advanced backcheck shall be located to begin cushioning the opening swing of the door at approximately 45 degrees. The intensity of the backcheck shall be fully adjustable by tamper resistant non-critical screw valve.
  5. Closers shall be installed to permit doors to swing 180 degrees.
  6. All closers shall utilize a stable fluid withstanding temperature range of 120 degrees Fahrenheit to minus 30 degrees Fahrenheit without requiring seasonal adjustment of closer speed to properly close the door.
  7. Drop brackets are required at narrow head rails.
  8. Maximum effort to operate doors shall not exceed 5 pounds for exterior doors and 5 pounds for interior doors, such pull or push effort being applied at right angles to hinged doors. Compensating devices or automatic door operators may be utilized to meet the above standards. When fire doors are required, the maximum effort to operate the door may be increased to min. allowable by appropriate admin authority not to exceed 15 pounds (CBC 1133B.2.5). All closers shall be adjusted to operate with the minimum amount of opening force and still close and latch the door. Reference CBC Sections 1133B.2.1, 1133B.2.5, 1133B2.5.1, and 1003.3.1.8. Doors shall take at least 3 seconds to move from an open position of 70 degrees to a point of 3 inches from the latch jamb.
  9. Provide sex-bolted or through bolt mounting for all door closers.
- E. Flush Bolts & Dust Proof Strikes: Ives as scheduled.
1. Automatic Flush Bolts shall be of the low operating force design. Utilize the top bolt only model for interior doors where applicable and as permitted by testing procedures.
  2. Manual flush bolts only permitted on storage or mechanical openings as scheduled.
  3. Provide dust proof strikes at openings using bottom bolts.

- F. Coordinators: Ives as scheduled; coordinator shall be a 1-5/8 inch wide by 5/8-inch high aluminum channel with the length variable to the door opening. It shall have a safety mechanism which will allow the active door to close first if under extreme pressure.
- G. Door Stops: Ives as scheduled.
  - 1. Unless otherwise noted in Hardware Sets, provide wall type with appropriate fasteners. Where wall type cannot be used, provide floor type. If neither can be used, provide overhead type.
  - 2. Do not install floor stops more than 4 inches from the face of the wall or partition (Title 24, 1133B.8.6).
  - 3. Overhead stops shall be made of stainless steel and non-plastic mechanisms and finished metal end caps. Field-changeable hold-open, friction and stop-only functions.
- H. Protection Plates: Fabricate either kick, armor, or mop plates with four beveled edges; provide kick plates 10 inches high and 2 inches LDW. Sizes of armor and mop plates shall be listed in the Hardware Schedule. Furnish with machine or wood screws of bronze or stainless to match other hardware.
- I. Lock Protectors: Lock astragals shall be provided with internally threaded fasteners for flat head machine screws. No hex head or carriage bolt fasteners will be permitted. Must be through bolted to door.
- J. Thresholds: As Scheduled and per details.
  - 1. Thresholds shall not exceed 1/2-inch in height, with a beveled surface of 1:2 maximum slope.
  - 2. Set thresholds in a full bed of butyl-rubber or polyisobutylene mastic sealant.
  - 3. Use 1/4-inch fasteners, red-head flat-head sleeve anchors (SS/FHSL).
  - 4. Thresholds shall comply with CBC Section 1133B.2.4.1.
- K. Seals: Sponge silicone gasket to meet ASTM E283-1984 test standards. Provide silicone gasket at all rated and exterior doors. All fire rated openings are to be in compliance with UBC 7.2 and UL 10C.
- L. Rain Drips: Provide rain drips at the heads of all exterior doors where there is not enough overhang to protect the opening.
- M. Door Shoes and Door Top Caps: Provide door shoes at all exterior wood doors and top caps at all exterior out-swing doors.
- N. Silencers: Furnish silencers for interior hollow metal frames, 3 for single doors, 2 for pairs of doors. Omit where sound or light seals occurs, or for fire-resistive-rated door assemblies.

### **2.03 KEYING**

- A. This is an existing Schlage Keying System. All permanent cores and /or cylinders are keyed by the District. Furnish all permanent Primus EP cores '0' Bitted and all permanent Classic E cores '1' Bitted. The District is to verify the Schlage Primus "EP" Level 3 and existing Classic "E" Keyway locations.
- B. Provide construction keying for doors requiring locking during construction; remove temporary cores immediately prior to District occupancy. Permanent cores and keys are to be shipped directly from the factory to the District.
- C. Keys: Supply keys and blanks as follows:
  - 1. Supply 2 each EP ('0'bitted) or E ('1' Bitted) change keys per lock.
  - 2. Supply 2 Cut Construction Control keys and 2 Permanent Cut Control keys.

**2.04 FINISHES**

- A. Generally to be Satin Chrome US 26D (626) unless otherwise noted.
- B. Furnish push plates, pull plates, and kick or armor plates in Stainless Steel US 32D (630) unless otherwise noted.
- C. Door closers shall be powder-coated to match other hardware, unless otherwise noted.

**2.05 FASTENERS**

- A. Screws for strikes, face plates and similar items shall be flat head, countersunk type, provide machine screws for metal and standard wood screws for wood.
- B. Screws for butt hinges shall be flathead, countersunk, full-thread type.
- C. Fastening of closer bases or closer shoes to doors shall be by means of sex bolts and spray painted to match closer finish.
- D. Provide expansion anchors for attaching hardware items to concrete or masonry.
- E. All exposed fasteners shall have a phillips head.
- F. Finish of exposed screws to match surface finish of hardware or other adjacent work.
- G. All Exit Devices and Lock Protectors shall be fastened to the door by the means of sex bolts or through bolts.

**PART 3 - EXECUTION**

**3.01 INSPECTION**

- A. Verify that doors and frames are square and plumb and ready to receive work and dimensions are as instructed by the manufacturer.
- B. Beginning of installation means acceptance of existing conditions.

**3.02 INSTALLATION**

- A. Install hardware in accordance with manufacturer's instructions and requirements of DHI.
- B. Use the templates provided by hardware item manufacturer.
- C. Mounting heights for hardware shall be as recommended by DHI. Operating hardware will to be located between 30 inches and 44 inches above the finished floor surface. Per CBC Section 1133B.2.5.1.
- D. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- E. Drill and countersink units that are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.
- F. Set thresholds for exterior doors in full bed of butyl-rubber sealant.

- G. If hand of door is changed during construction, make necessary changes in hardware at no additional cost.

**3.03 ADJUST AND CLEAN**

- A. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.
- B. Clean adjacent surface soiled by hardware installation.
- C. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy, return to that work area and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.
- D. Instruct the District's Personnel in proper adjustment and maintenance of hardware finishes, during the final adjustment of hardware.

**3.04 HARDWARE LOCATIONS**

- A. Conform to CCR, Title 24, Part 2, and ADAAG for positioning requirements for persons with disabilities. Operating hardware to be mounted between 30 inches and 44 inches above finished floor.

**3.05 FIELD QUALITY CONTROL**

- A. Architectural Hardware Consultant (AHC) to inspect installation and certify that hardware and its installation have been furnished and installed in accordance with manufacturer's instructions and as specified herein.

**3.06 SCHEDULE**

- A. The items listed in the following schedule shall conform to the requirements of the foregoing Specifications.
- B. The Door Schedule on the Drawings indicates which hardware set is used with each door.

**Manufacturers Abbreviations (Mfr.)**

GLY	=	Glynn-Johnson Corporation	Overhead Stops
HAG	=	Hager	Hinges
IVE	=	Ives	Push/Pulls, Protection Plates, and Stops
LCN	=	LCN	Door Closers, Auto Operators
NGP	=	National Guard Products	Thresholds, Gasketing and Weatherstripping
SCH	=	Schlage Lock Company	Locks, Latches and Cylinders
VON	=	Von Duprin	Exit Devices and Mullions

SPECWORKS # 104131-B7NI38JP2

HW SET: 01 EXTERIOR PAIR / PANIC HARDWARE / ACCESS CONTROL / KEYPAD/CARD READER

DOOR NUMBER:

30A

EACH TO HAVE:

7 EA HINGE

BB1199 5 X 4.5 NRP

32D HAG

1	EA	THRU-WIRE HINGE	BB1199 5 X 4.5 ETW-8	32D	HAG
1	EA	MULLION	KR4954 X 154	689	VON
1	EA	PANIC HARDWARE	99EO 4'	626	VON
1	EA	PANIC HARDWARE	99L E996L X 17 X 4' FSE 24VDC	626	VON
1	EA	PERMANENT CORE	20-740 (PRIMUS)	626	SCH
1	EA	RIM CYLINDER	20-057T X (CONST CORE)	626	SCH
1	EA	MORTISE CYLINDER	20-771 (FOR MULLION)	626	SCH
1	EA	MULLION SEAL	5100	BLK	NGP
2	EA	SURFACE CLOSER	4041 EDA	689	LCN
2	EA	FLOOR STOP & HOLDER	FS43	626	IVE
1	SET	SEALS	2525B	BRN	NGP
2	EA	DOOR SWEEP	200NA	AL	NGP
2	EA	DOOR CONTACT	PROVIDED UNDER SECURITY SECTION		
1	EA	KEY PAD/CARD READ	PROVIDED UNDER SECURITY SECTION		
1	EA	POWER SUPPLY	PROVIDED UNDER SECURITY SECTION		
1	EA	REQUEST TO EXIT	PROVIDED UNDER SECURITY SECTION		

NOTE: THIS OPENING HAS ELECTRIFIED TRIM PANIC HARDWARE AND A KEYPAD / CARD READER.

HW SET: 02 EXTERIOR PAIR / PANIC HARDWARE / ACCESS CONTROL / CARD READER

DOOR NUMBER:

30B

EACH TO HAVE:

7	EA	HINGE	BB1199 4.5 X 4.5 NRP	32D	HAG
1	EA	THRU-WIRE HINGE	BB1199 4.5 X 4.5 ETW-8	32D	HAG
1	EA	MULLION	KR4954 X 154	689	VON
1	EA	PANIC HARDWARE	99EO 3'	626	VON
1	EA	PANIC HARDWARE	99L E996L X 17 X 3' FSE 24VDC	626	VON
1	EA	PERMANENT CORE	20-740 (PRIMUS)		
1	EA	RIM CYLINDER	20-057T X (CONST CORE)	626	SCH
1	EA	MORTISE CYLINDER	20-771 (FOR MULLION)	626	SCH
1	EA	MULLION SEAL	5100	BLK	NGP
2	EA	SURFACE CLOSER	4041 EDA	689	LCN
2	EA	FLOOR STOP & HOLDER	FS43	626	IVE
1	SET	SEALS	2525B	BRN	NGP
2	EA	DOOR SWEEP	200NA	AL	NGP
1	EA	CARD READER	PROVIDED UNDER SECURITY SECTION		
2	EA	DOOR CONTACT	PROVIDED UNDER SECURITY SECTION		
1	EA	POWER SUPPLY	PROVIDED UNDER SECURITY SECTION		
1	EA	REQUEST TO EXIT	PROVIDED UNDER SECURITY SECTION		

NOTE: THIS OPENING HAS ELECTRIFIED TRIM PANIC HARDWARE AND A CARD READER.

HW SET: 03 INTERIOR / ELECTRICAL

DOOR NUMBER:

16A

EACH TO HAVE:

1	EA	CONTINUOUS HINGE	SL11	AL	SEL
1	EA	STOREROOM LOCK	ND80TD SPA	626	SCH
1	EA	PERMANENT CORE	20-740 (PRIMUS)	626	SCH
1	EA	SURFACE CLOSER	4041PA	689	LCN
1	EA	DOME STOP	FS436	626	IVE
1	SET	WEATHER SEAL	SUPPLY WITH DOOR AND FRAME ASSEMBLY		

HW SET: 04 EXTERIOR / MECH & TRANSFORMER / PANIC HARDWARE

DOOR NUMBER:

16B

EACH TO HAVE:

1	EA	CONTINUOUS HINGE	SL11	AL	SEL
1	EA	PANIC HARDWARE	99L 996L X 17 X 4'	626	VON
1	EA	IC RIM CYLINDER	20-057T X ICX (CONST CORE)	626	SCH
1	EA	PERMANENT CORE	20-740 (PRIMUS)	626	SCH
1	EA	SURFACE CLOSER	4041 EDA	689	LCN
1	EA	FLOOR STOP & HOLDER	FS43	626+	IVE
1	SET	WEATHER SEAL	SUPPLY WITH DOOR AND FRAME ASSEMBLY		
1	EA	DOOR SWEEP	200NA	AL	NGP
1	EA	THRESHOLD	PER DETAIL	AL	

HW SET: 05 EXTERIOR PAIR OF CHAINLINK GATES

DOOR NUMBER:

3A

EACH TO HAVE:

1	EA	PERMANENT CORE	20-740 (PRIMUS)	606	SCH
1	EA	PADLOCK	KS43F3200	452	SCH

HW SET: 06 EXTERIOR PAIR OF GATES

DOOR NUMBER:

16C

EACH TO HAVE:

8	EA	HINGES	EXTRA HEAVY WT WELDABLE HINGES / BY GATE MFG		
1	EA	STOREROOM LOCK	ND96TD SPA 14-042	626	SCH
1	EA	PERMANENT CORE	20-740 (PRIMUS)	626	SCH
2	EA	CANE BOLT	BY GATE MFG		
4	EA	STRIKES	BY GATE MFG		

HW SET: 07 EXTERIOR / SGL GATE

DOOR NUMBER:

16D

EACH TO HAVE:

1	EA	STOREROOM LOCK	ND96TD SPA	626	SCH
1	EA	PERMANENT CORE	20-740 (PRIMUS)	626	SCH
		BALANCE OF HDWE	BY GATE MFG		

HW SET: 08

DOOR NUMBER:

DRIVEWAY GATE

EACH TO HAVE:

2	EA	PADLOCKS	3770 / PADLOCKS FOR DRIVEWAY CHAIN		KNO
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**END OF SECTION**



# Catalog Cuts

for

CANADA COLLEGE ELECTRICAL INFRASTRUCTURE PROJECT

Sorted by Manufacturer

Prepared By

BOB MANTHEY

INGERSOLL RAND SECURITY TECHNOLOGIES

6689 OWENS DRIVE SUITE 200

PLEASANTON CA 94588

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Created 9/2/2010

104131

Catalog Cut Summary

Mfgr	Description	Item#	Catalog Number	PAGE
HAG	HINGE		BB1199 4.5 X 4.5 NRP	4
HAG	HINGE		BB1199 5 X 4.5 NRP	4
HAG	THRU-WIRE HINGE		BB1199 4.5 X 4.5 ETW-8	5
HAG	THRU-WIRE HINGE		BB1199 5 X 4.5 ETW-8	5
IVE	DOME STOP		FS436	6
IVE	FLOOR STOP & HOLDER		FS43	7
KNO	PADLOCKS		3770 / PADLOCKS FOR DRIVEWAY CHAIN	No Cut
SCH	PADLOCK		KS43F3200	8
LCN	SURFACE CLOSER		4041PA	9
LCN	SURFACE CLOSER		4041 EDA	9
NGP	SEALS		2525B	18
NGP	DOOR SWEEP		200NA	19
NGP	MULLION SEAL		5100	20
SCH	PERMANENT CORE		20-740 (PRIMUS)	21
SCH	RIM CYLINDER		20-057T X (CONST CORE)	22
SCH	IC RIM CYLINDER		20-057T X ICX (CONST CORE)	22
SCH	MORTISE CYLINDER		20-771 (FOR MULLION)	23
SCH	STOREROOM LOCK		ND96TD SPA 14-042	24
SCH	STOREROOM LOCK		ND80TD SPA	24
SCH	STOREROOM LOCK		ND96TD SPA	24
SEL	CONTINUOUS HINGE		SL11	30
VON	MULLION		KR4954 X 154	32
VON	PANIC HARDWARE		99EO 3'	33
VON	PANIC HARDWARE		99EO 4'	33

Catalog Cut Summary

Mfgr	Description	Item#	Catalog Number	PAGE
VON	PANIC HARDWARE		99L 996L X 17 X 4'	33
VON	PANIC HARDWARE		99L E996L X 17 X 3' FSE 24VDC	33
VON	PANIC HARDWARE		99L E996L X 17 X 4' FSE 24VDC	33
VON	GLOBAL CUT		GLOBAL CUT	35
VON	GLOBAL CUT		GLOBAL CUT	36
VON	GLOBAL CUT		GLOBAL CUT	37
VON	GLOBAL CUT		GLOBAL CUT	38
VON	GLOBAL CUT		GLOBAL CUT	39
VON	GLOBAL CUT		GLOBAL CUT	40
VON	GLOBAL CUT		GLOBAL CUT	41
VON	GLOBAL CUT		GLOBAL CUT	42
VON	GLOBAL CUT		GLOBAL CUT	43



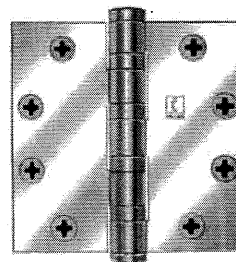
# Full Mortise Hinges

**Ball Bearing • Heavy Weight • Template**  
**For use on Heavy Weight Doors or Doors Requiring High Frequency Service**

**BB1168**  
**Steel with steel pin ANSI A8111**

**BB1199**  
**Brass with stainless steel pin ANSI A2111**  
**Stainless Steel with stainless steel pin ANSI A5111**

Five knuckle four ball bearings non-rising removable pin with button tip and plug.  
 Specify screw requirements.



For Hospital type  
 prefix "HT" to  
 catalog number

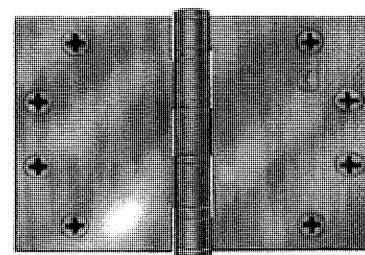
Hinge Size		Gauge of metal	Number of holes	Screw Size		Quantity		Avg weight per case (lbs)	
Inches	Millimeters			Machine	Wood	Box	Case	Steel	SSteel/Brass
4½ x 4	114 x 102	0.180	8	½ x 12-24	1¼ x 12	3 each	24 each	35	38
4½ x 4½	114 x 114	0.180	8	½ x 12-24	1¼ x 12	3 each	24 each	35	38
5 x 4	127 x 102	0.190	8	½ x 12-24	1¼ x 12	3 each	24 each	44	48
5 x 4½	127 x 114	0.190	8	½ x 12-24	1¼ x 12	3 each	24 each	44	48
5 x 5	127 x 127	0.190	8	½ x 12-24	1¼ x 12	3 each	24 each	44	48
6 x 4½	152 x 114	.203 Steel & Brass	10	½ x 1¼-20	1½ x 14	3 each	24 each	70	65
6 x 5	152 x 127	.203 SS	10	½ x 1¼-20	1½ x 14	3 each	24 each	70	65
6 x 6	152 x 152	.203 Steel & Brass	10	½ x 1¼-20	1½ x 14	3 each	24 each	70	65
8 x 6	203 x 152	.203 SS	16	½ x 1¼-20	1½ x 14	3 each	12 each	67	62
8 x 8	203 x 203	.203 Steel & Brass	16	½ x 1¼-20	1½ x 14	3 each	12 each	67	62

**Ball Bearing • Heavy Weight • Template • Wide Throw**  
**For use on Heavy Weight door or doors Requiring High Frequency Service**

**BB1168 - Wide Throw**  
**Steel with steel pin ANSI A5111**

**BB1199 - Wide Throw**  
**Brass with brass pin ANSI A2111**  
**Stainless Steel with stainless steel pin ANSI A5111**

Five knuckle four ball bearings non-rising removable pin with tip and plug.  
 Specify Screw Requirements.



Hinge Size		Gauge of metal	Number of holes	Screw Size		Quantity		Avg weight per case (lbs)	
Inches	Millimeters			Machine	Wood	Box	Case	Steel	SSteel/Brass
4½ x 5	114 x 127	0.180	8	½ x 12-24	1¼ x 12	3 each	24 each	55	60
4½ x 6	114 x 152	0.180	8	½ x 12-24	1¼ x 12	3 each	24 each	55	60
4½ x 7	114 x 178	0.180	8	½ x 12-24	1¼ x 12	3 each	24 each	55	60
4½ x 8	114 x 203	0.180	8	½ x 12-24	1¼ x 12	3 each	24 each	55	60
5 x 6	127 x 152	0.190	8	½ x 12-24	1¼ x 12	3 each	12 each	32	35
5 x 7	127 x 178	0.190	8	½ x 12-24	1¼ x 12	3 each	12 each	32	35
5 x 8	127 x 203	0.190	8	½ x 12-24	1¼ x 12	3 each	12 each	32	35

Hinge testing conforms to ANSI A156.1. Furnished with screw hole locations that conform to standards approved by ANSI A156.7.

**VISIT US AT: WWW.HAGERCO.COM**

**A5**

**"THE FIRST FAMILY OF SUPERIOR HARDWARE"**

rev. 7/02



# Full Mortise Hinges

## Three Knuckle Concealed Electric Hinges

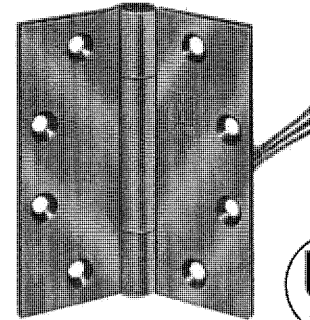
Available on 4" x 4" (102 x 102 mm), 4 1/2" x 4 1/2" (114 x 114 mm), and 5" x 5" (127 x 127 mm) architectural grade full mortise hinges.

Type: AB700, AB800 Standard Weight  
AB750, AB850 Heavy Weight

Available in Steel, Brass, and Stainless Steel

### Electric Monitor Only – EMN

- Other Sizes Available Upon Request.
- Specify using suffix "EMN"  
Example: AB800 5 x 4 1/2 x US26D x EMN
- Hinge pins are **not** field removable. **NRP variation is therefore not necessary nor available.**



### Electric Monitor Only – EMN

For doors which require a monitoring capability only. The EMN is a monitoring hinge with a concealed subminiature, snap action, SPDT switch.

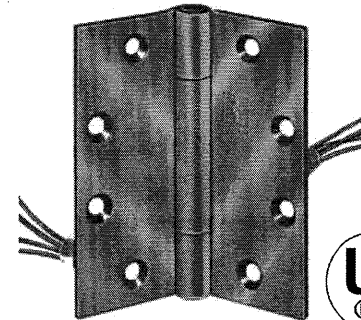
The exclusive adjustment feature provides a wide range of switch sensitivity. The switching circuit is preset at the factory to operate when the inside edge of the hinge leaves are opened between 3/16 to 3/8 inches (5 to 10 mm). 28 gauge wire is used.

Means for adjustment is provided on the frame leaf of the hinge for those installations which require an adjustment of switch sensitivity. Total control of the monitoring sensitivity may be achieved by removing the screws from the frame leaf only, then inserting the adjusting tool for fine tuning of the snap-action switch. See installation instructions for further directions.

Maximum Electrical Rating	
Volts	48 VDC/AC
Amperes	1 Amp
Watts	15
Volt Amperes	16

### Electric Through-Wire Only – ETW

- Other Sizes Available Upon Request.
- Specify using suffix "ETW"  
Example: AB700 5 x 4 1/2 x US10A x ETW
- Hinge pins are **not** field removable. **NRP variation is therefore not necessary nor available.**



### Electric Through-Wire Only – ETW

For doors which require low voltage electric current transfer capability only.

The ETW is a through-wire hinge which provides 4, 6, 8, 10 or 12 continuous electric conductors for transfer of current from frame to door. 28 gauge wire is used.

Maximum Electrical Rating	
Amperes	3.5 Amps CONTINUOUS 16.0 Amps PULSE

### Electric Through-Wire with Monitoring – ETM

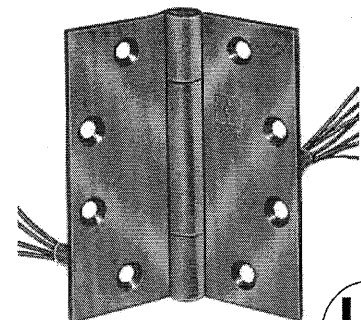
- Other Sizes Available Upon Request.
- Specify using suffix "ETM"  
Example: AB750 5 x 4 1/2 x US10A x ETM
- Hinge pins are **not** field removable. **NRP variation is therefore not necessary nor available.**

### Electric Through-Wire with Monitoring – ETM

For doors requiring both continuous electric conductors and monitoring capability.

The ETM is a combination of the Hager Through-Wire and Monitoring hinges. This hinge offers the concealed monitoring switch and (4, 6, 8 or 10 wire) continuous electrical conductors. 28 gauge wire is used. The adjustment features, as stated in the Electric Monitor hinge, are also applicable in this hinge.

The EMN and ETM switch may be wired for Open Loop Secure, Closed Loop Secure or Single Pole Double Throw (SPDT). The Open Loop Secure hinges are wired so that when the door is secure (closed) the switch is open (does not pass current). When the door opens a closed contact is detected as an alarm. Closed Loop Secure hinges are wired so that when the door is secure (closed) the switch is closed (passes current). When the door opens, an open contact is detected as an alarm. When Single Pole Double Throw (SPDT) wiring is used both switching arrangements are utilized. Templates available upon request.



Patent No. 4,284,861



#### NOTES:

1. All electric hinge modifications are to be placed in the **center** hinge position. Any other location will void warranty.
2. For grout filled frames, install Hager #430 mortar box. Failure to install mortar box in grout filled frames will void warranty.

All electric hinges are packed one hinge per box with all MS and 1/2 WS screws, unless otherwise ordered.

**VISIT US AT: WWW.HAGERCO.COM**

**A9**

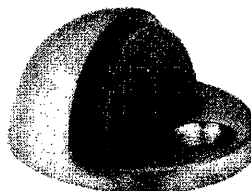
**"THE FIRST FAMILY OF SUPERIOR HARDWARE"**

rev. 7/02

# Floor Stops – Dome

## FS436 Dome Stop

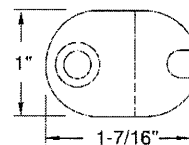
- For doors without threshold.
- Heavy-Duty Cast Dome Stops constructed of brass, bronze or aluminum.
- Gray, non-marring rubber bumper.
- Packed with wood screw and plastic anchor, specify Tampin (TPN) or lead expansion shield (LS), if required.
- Meets ANSI/BHMA 156.6, L12141 for brass or bronze, L32141 for aluminum.
- Finishes: US3, US4, US5, US10, US10B, US26, US26D and US28.



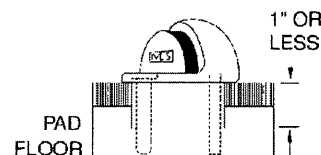
Product No.	Overall Height	Base Height	Base Diameter
FS436	1"	3/16"	1-3/4" x 2" Oval

## FS435 Riser

- Extruded aluminum, mill finish.
- For conversion of FS436 Dome Stop to carpet installation.
- Packed with wood screws, lead shield and stud. Specify Tampin (TPN) if required.
- Available in 1/4", 1/2", 3/4" and 1" height.



Product No.	Size
FS435	1" x 1-7/16" Oval



## How to Order:

FS - - -

### Model:

- 436 Dome Stop Only
- 435 Riser Only
- 436 x 435 Dome Stop & Riser

### Riser Size:

- Blank No riser
- 1/4 for 1/4"
- 1/2 for 1/2"
- 3/4 for 3/4"
- 1 for 1"

### Finishes:

US3, US4, US5, US10, US10B, US26, US26D, US28

### Mounting:

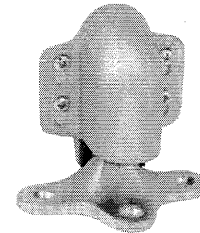
- Blank Standard
- TPN Tampin
- LS Lead Expansion Shield

# Floor Door Stop & Automatic Holder

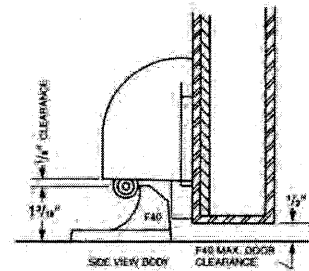
**FS40**  
**FS41**  
**FS42**  
**FS43**

**Features:**

- Automatic door holders ideal for heavy-traffic situations that require a simple, fool-proof, Hold-Open device.
- Forged from brass.
- Unit is activated automatically when door is opened. A firm pull on door releases the mechanism.
- Strikes accommodate different door to floor clearances.
- Model numbers are determined by strike/door-to-floor clearances.
- Holder position on door is adjustable.
- Universal screw pack allows for installation in all types of door construction.
- Meets ANSI/BHMA 156.16, L11301.
- Finishes: US3, US4, US10, US10B, US26, US26D.

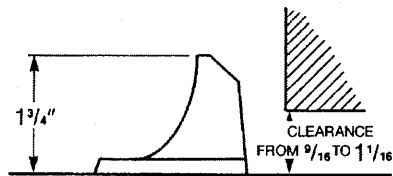


Product No.	Door to Floor Clearance	Holder Dimensions
FS40	1/2" or less	3" Wide x 3-11/16" High
FS41	9/16" to 1-1/16"	3" Wide x 3-11/16" High
FS42	1-1/8" to 1-9/16"	3" Wide x 3-11/16" High
FS43	1-5/8" to 2-1/16"	3" Wide x 3-11/16" High

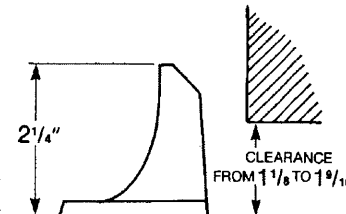


FS40

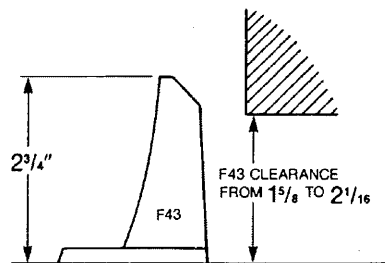
**Optional Strike Details**



FS41



FS42

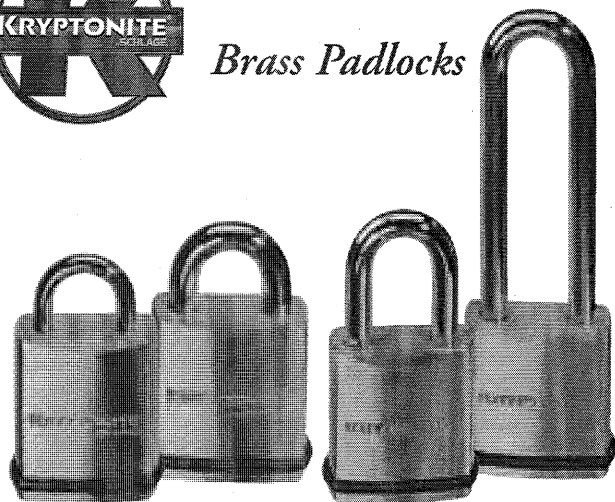


FS43





## Brass Padlocks



### FEATURES & SPECIFICATIONS

- Solid Brass Body Resists Corrosion For All Weather Performance
- Molybdenum Hardened Steel Shackle Offers Greater Cut Resistance
- Double Deadbolt Locking Mechanism Provides Extra Security
- Patented Interchangeable Shackle Design Allows for Easy Disassembly
- Standard Cylinder Features Include:
  - Schlage Conventional Key-In-Knob (KNK) Cylinder
    - 6-Pin Solid Brass Cylinder (pinned 5) Offers Increased Pick Resistance
    - Two Nickel Silver Cut Schlage Keys

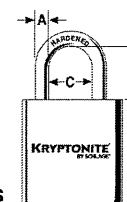
### ASTM STANDARDS

- Meets or exceeds ASTM standards for standard steel shackle, shackle cutting and corrosion resistance.

Part #	Body Size			Shackle Dimension			Shackle Dimension (metric)			Cylinder Type	Case Pack	Master Pack	List Price Each
	Width	Height	Depth	A	B	C	A	B	C				
<b>KEYED DIFFERENT</b>													
KS13A2300	1 25/32"	2 3/16"	7/8"	1/4"	3/4"	3/4"	6.4mm	19mm	19mm	KNK	6	24	\$38.90
KS13D2300	1 25/32"	2 3/16"	7/8"	1/4"	1 1/2"	3/4"	6.4mm	38mm	19mm	KNK	6	24	\$39.75
KS13F2300	1 25/32"	2 3/16"	7/8"	1/4"	2"	3/4"	6.4mm	51mm	19mm	KNK	6	24	\$39.90
KS13G2300	1 25/32"	2 3/16"	7/8"	1/4"	4"	3/4"	6.4mm	102mm	19mm	KNK	6	24	\$41.67
KS23A2300	1 25/32"	2 3/16"	7/8"	5/16"	3/4"	3/4"	8mm	19mm	19mm	KNK	6	24	\$41.02
KS23D2300	1 25/32"	2 3/16"	7/8"	5/16"	1 1/2"	3/4"	8mm	38mm	19mm	KNK	6	24	\$42.08
KS23F2300	1 25/32"	2 3/16"	7/8"	5/16"	2"	3/4"	8mm	51mm	19mm	KNK	6	24	\$42.27
KS23G2300	1 25/32"	2 3/16"	7/8"	5/16"	4"	3/4"	8mm	102mm	19mm	KNK	6	24	\$44.49
KS43A2300	1 15/16"	2 3/16"	7/8"	3/8"	3/4"	3/4"	9.5mm	19mm	19mm	KNK	6	24	\$43.37
KS43D2300	1 15/16"	2 3/16"	7/8"	3/8"	1 1/2"	3/4"	9.5mm	38mm	19mm	KNK	6	24	\$44.70
KS43F2300	1 15/16"	2 3/16"	7/8"	3/8"	2"	3/4"	9.5mm	51mm	19mm	KNK	6	24	\$44.93
KS43G2300	1 15/16"	2 3/16"	7/8"	3/8"	4"	3/4"	9.5mm	102mm	19mm	KNK	6	24	\$47.71
<b>KEYED ALIKE</b>													
KS13A21x0*	1 25/32"	2 3/16"	7/8"	1/4"	3/4"	3/4"	6.4mm	19mm	19mm	KNK	6	24	\$38.90
KS13F21x0*	1 25/32"	2 3/16"	7/8"	1/4"	2"	3/4"	6.4mm	51mm	19mm	KNK	6	24	\$39.90
KS23A21x0*	1 25/32"	2 3/16"	7/8"	5/16"	3/4"	3/4"	8mm	19mm	19mm	KNK	6	24	\$41.02
KS23F21x0*	1 25/32"	2 3/16"	7/8"	5/16"	2"	3/4"	8mm	51mm	19mm	KNK	6	24	\$42.27
KS43A21x0*	1 15/16"	2 3/16"	7/8"	3/8"	3/4"	3/4"	9.5mm	19mm	19mm	KNK	6	24	\$43.37
KS43F21x0*	1 15/16"	2 3/16"	7/8"	3/8"	2"	3/4"	9.5mm	51mm	19mm	KNK	6	24	\$44.93
<b>LESS SHACKLE/LESS CYLINDER<sup>1</sup></b>													
KS13P2200	1 25/32"	2 3/16"	7/8"	1/4"	n/a	3/4"	6.4mm	n/a	19mm	KNK	6	24	\$19.30
KS23P2200	1 25/32"	2 3/16"	7/8"	5/16"	n/a	3/4"	8mm	n/a	19mm	KNK	6	24	\$20.52
KS43P2200	1 15/16"	2 3/16"	7/8"	3/8"	n/a	3/4"	9.5mm	n/a	19mm	KNK	6	24	\$21.75

\*Available in 10 key codes. When ordering specify code where x = A, B, C, D, E, F, G, H, J or K.

**NOTE:** 1) Padlock bodies ship without a shackle or cylinder. Driver and all other internal padlock parts are included.

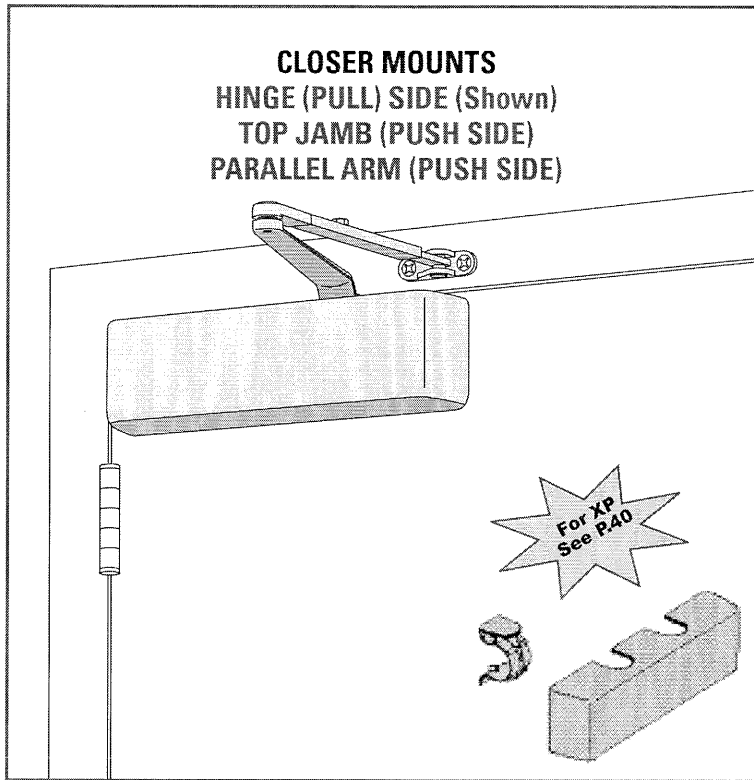


Shackle Dimensions



# LCN 4040 SERIES

FEATURES



*The 4040 SUPER SMOOTH® is LCN's most flexible heavy duty closer designed for institutional and other rugged high traffic applications.*

- ▶ Ten Million Cycles
- ▶ Cast Iron
- ▶ Forged Steel Arm
- ▶ Double Heat Treated Steel Pinion
- ▶ All Weather Fluid
- ▶ Non-Handed
- ▶ LCN® Fast™ Power Adjust
- ▶ Fast & Accurate Installation
- ▶ UL & cUL Listed
- ▶ For XP See Page 40

- ▶ Standard 4040 series closer shipped with regular arm, standard plastic clip-on cover, and self reaming and tapping screws. See 4040 Series pages 45-47 for options.
- ▶ Non-sized cylinder is adjustable for interior doors to 5'0" and exterior doors to 4'0".
- ▶ Closer mounts hinge side, top jamb, and parallel arm w/PA Shoe on either right or left swinging doors.
- ▶ Closers to meet ADA requirements. See 4040 Series page 48.
- ▶ Standard or optional custom powder coat finish.
- ▶ Optional plated finish on cover, arm, and fasteners.
- ▶ Optional SRI primer for installations in corrosive conditions.
- ▶ Optional designer series metal cover
- ▶ UL and cUL listed for self-closing doors without hold-open.
- ▶ Tested and certified under ANSI Standard A156.4, grade one.



MOUNTING					FINISH			COVER			CYLINDER			**ARM FUNCTION								
HINGE (PULL) SIDE	TOP JAMB (PULL)	TOP JAMB (PUSH)	PARALLEL ARM	STOP FACE	POWDER COAT	PLATED	PLASTIC	METAL	DESIGNER METAL	NON-HANDED	NON-SIZED	ACCESSIBILITY	DELAYED ACTION	AVB***	XP	REGULAR (DOUBLE)	STANDARD (SINGLE)	HOLD-OPEN	FUSIBLE LINK	EDA/HEDA	CUSH/H/CUSH	SCUSH/S/H/CUSH
●	○	●	●	○	●	●	●	●	●	●	○	○	○	○	○	120°	○	120°	○	180°	110°	110°

● Available  
○ Not available

♿ Closer available with less than 5.0 lbs. opening force on 36" door.  
 \*\*Maximum opening/hold-open point with standard template.  
 \*\*\* Advanced Variable Backcheck



# LCN 4040 SERIES

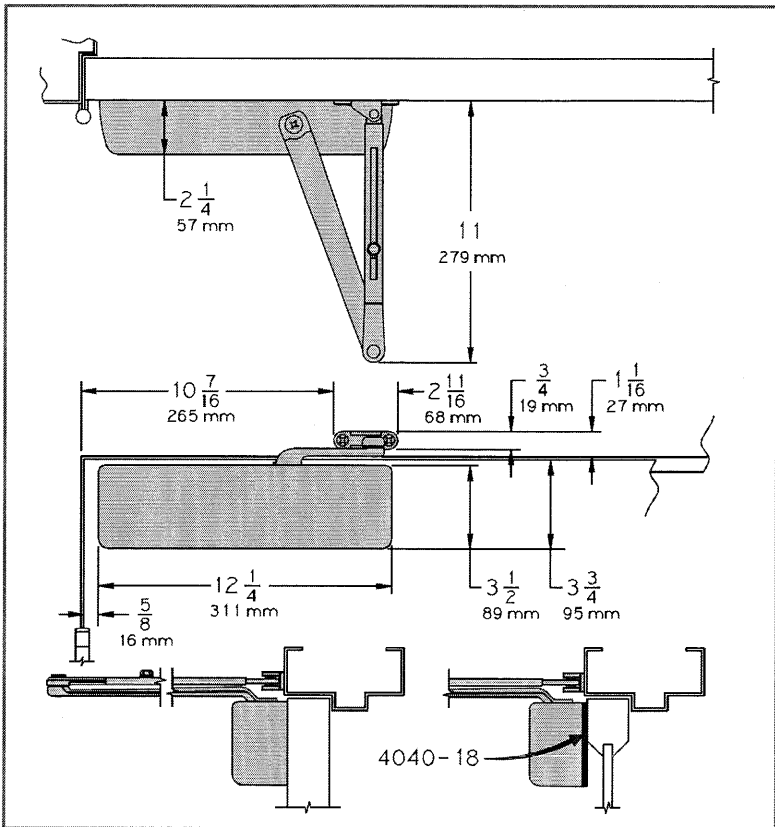
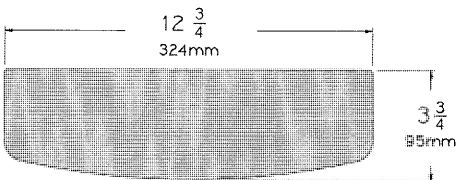
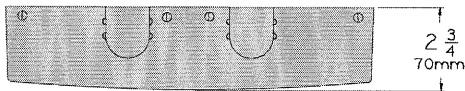
## HINGE (PULL) SIDE MOUNTING

### MAXIMUM OPENING

Templating allows up to 120°.

Hold-open points 90° up to 120° with hold-open arm.

### Optional, Non-handed Designer Series Metal Cover



MOUNTING DETAILS

### Options

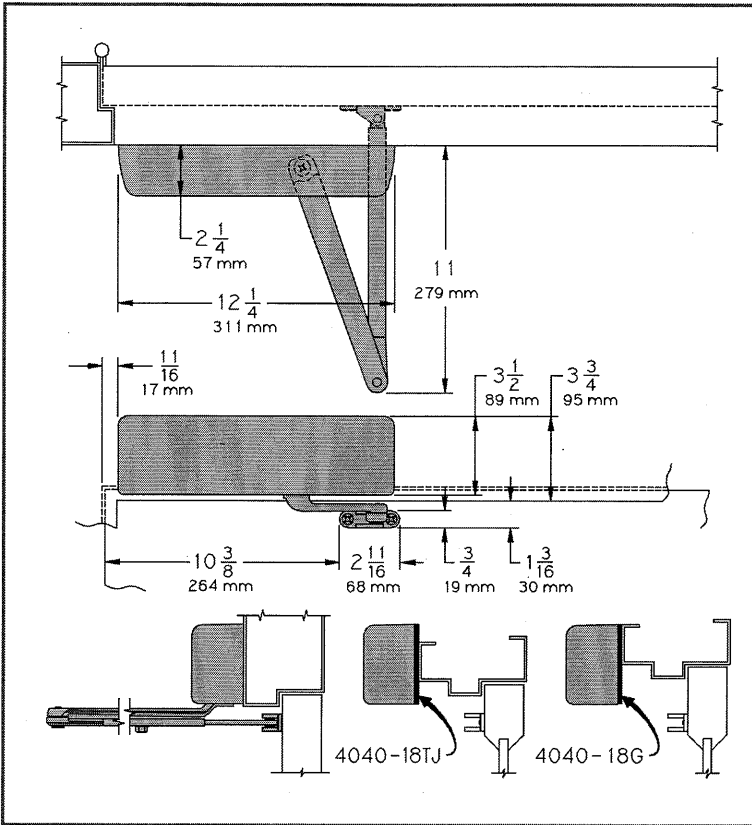
- ▶ 4040XP cylinder
- ▶ 4041 Delayed action cylinder.
- ▶ Hold-open arm.
- ▶ Metal or lead lined cover.
- ▶ Corner bracket.
- ▶ Designer Series metal cover.

### Special Templates

Customized installation templates or products may be available to solve unusual applications. Contact LCN for assistance.

- ▶ **Butt Hinges** should not exceed 5" (127 mm) in width.
- ▶ **Auxiliary Stop** is recommended at hold-open point or where a door cannot swing beyond 120°.
- ▶ **Reveal** should not exceed 3/4" (19 mm) for regular arm or hold-open arm.
- ▶ **Top Rail** less than 3 3/4" (95 mm) requires PLATE, 4040-18. Plate requires 2" (51 mm) minimum. With Designer Series metal cover, use PLATE, 4040-18DS1
- ▶ **Clearance** of 2 3/8" (60 mm) behind door required for 90° installation. 2 7/8" (73 mm) for Designer Series metal covers
- ▶ **Delayed Action** (not available on 4040XP) Add suffix "DEL" to selected cylinder (eg. 4041 DEL). Delays closing from 120° to 70°. Delay time adjustable up to approximately 1 minute.
- ▶ **Bull Nose Trim** requires SOFFIT SHOE, 4040-65.
- ▶ **Corner Bracket** available for doors where top jamb or parallel arm mounting can not be used. 4040-16 allows 110° opening. Projects 5" (127 mm) from stop, 12 13/16" (325 mm) from frame. 4040-17 allows 100° opening with certain auxiliary door holders (consult factory). Projects 6 3/8" (162 mm) from stop, 13 11/16" (348 mm) from frame.

**MOUNTING DETAILS**



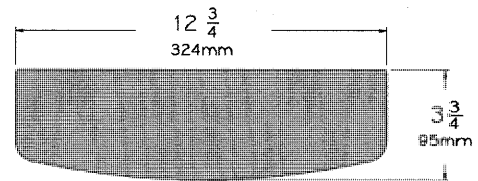
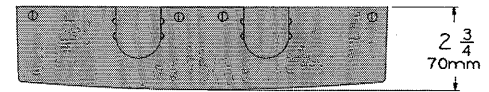
**TOP JAMB (PUSH SIDE)  
MOUNTING**

**MAXIMUM OPENING**

Templating allows up to 120°.

Hold-open points 85° up to 120° with hold-open arm.

*Optional, Non-handed  
Designer Series  
Metal Cover*



- ▶ **Butt Hinges** should not exceed 5" (127 mm) in width.
- ▶ **Auxiliary Stop** is recommended at hold-open point or where the door cannot swing 120°.
- ▶ **Reveal** of 2 9/16" (65 mm) allows 120° opening for REGULAR ARM or standard HOLD-OPEN ARM. 4 13/16" (122 mm) allows up to 120° opening with LONG ARM where standard rod and shoe is replaced with optional LONG ROD AND SHOE 4040-79LR. Use H-LONG ARM with LONG HEAD AND TUBE, 4040-78HL for hold-open. 8" (203 mm) allows up to 120° opening with EXTRA LONG ARM where standard rod and shoe is replaced with optional EXTRA LONG ROD AND SHOE, 4040-79ELR.
- ▶ **Top Rail** requires 1 1/4" (32 mm) minimum.  
2 1/4" (57 mm) minimum with closer on PLATE, 4040-18TJ.  
3" (76 mm) minimum with closer on PLATE, 4040-18G. With Designer Series metal cover, use PLATE, 4040-18TJDS1
- ▶ **Head Frame** less than 3 1/2" (89 mm) requires PLATE, 4040-18TJ. With flush ceiling, use PLATE, 4040-18G. Either plate requires 1 3/4" (44 mm) minimum.
- ▶ **Delayed Action** (not available on 4040XP) Add suffix "DEL" to selected cylinder (eg. 4041 DEL). Delays closing from 120° to 80°. Delay time adjustable up to approximately 1 minute.

**Options**

- ▶ 4040XP cylinder
- ▶ 4041 Delayed action cylinder.
- ▶ Long arm, extra long arm, hold-open arm, long hold-open arm.
- ▶ Metal or lead lined cover.
- ▶ Designer Series metal cover.

**Special Templates**

Customized installation templates or products may be available to solve unusual applications. Contact LCN for assistance.

# LCN 4040 SERIES

## PARALLEL ARM (PUSH SIDE) MOUNTING

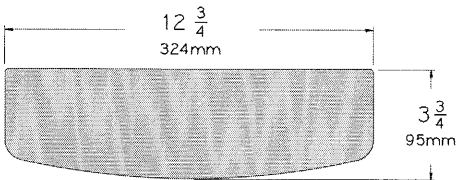
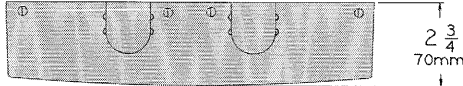
Optional mounting requires PA SHOE, 4040-62PA for REGULAR or HOLD-OPEN arms. Add prefix "P" to closer description (eg. P4041). P4041 closer includes 4040-201 FIFTH HOLE SPACER to support PA SHOE.

## MAXIMUM OPENING

180° opening/hold-open points with all except CUSH arms.

110° opening/hold-open with CUSH arms.

### Optional, Non-handed Designer Series Metal Cover

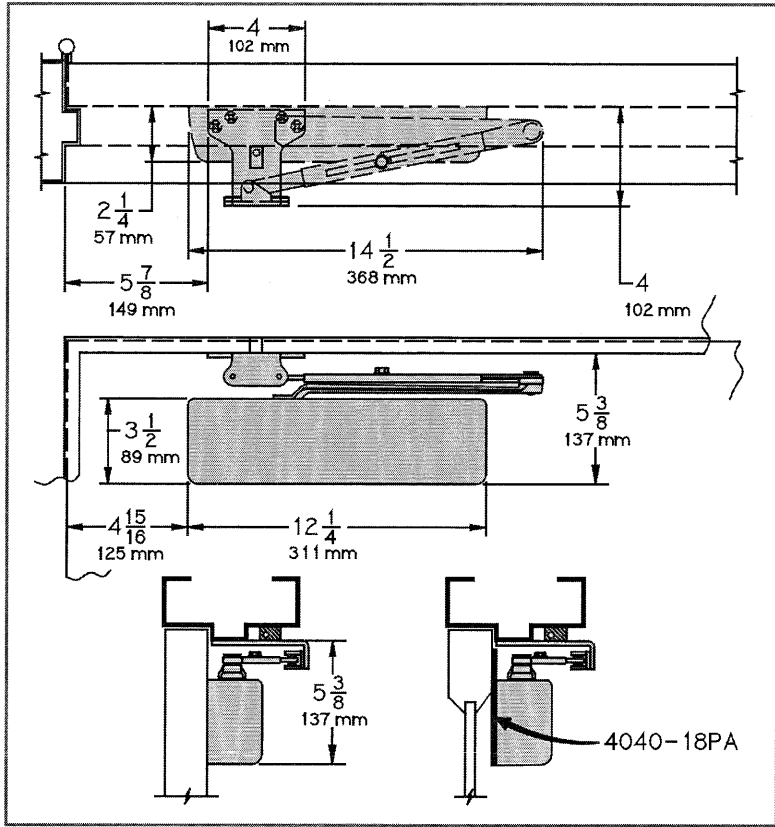


### Options

- ▶ 4040XP cylinder
- ▶ 4041 Delayed action cylinder.
- ▶ Hold-open, EDA, HEDA, CUSH, HCUSH, SPRING CUSH, or SPRING HCUSH arm.
- ▶ Metal or lead lined cover.
- ▶ Designer Series metal cover.

### Special Templates

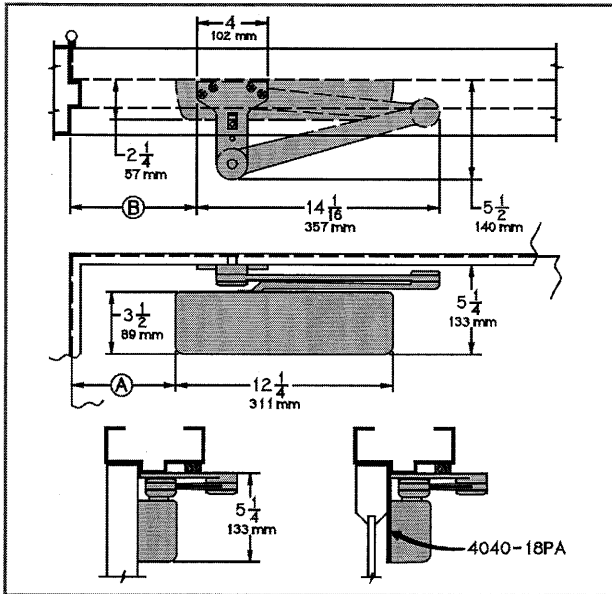
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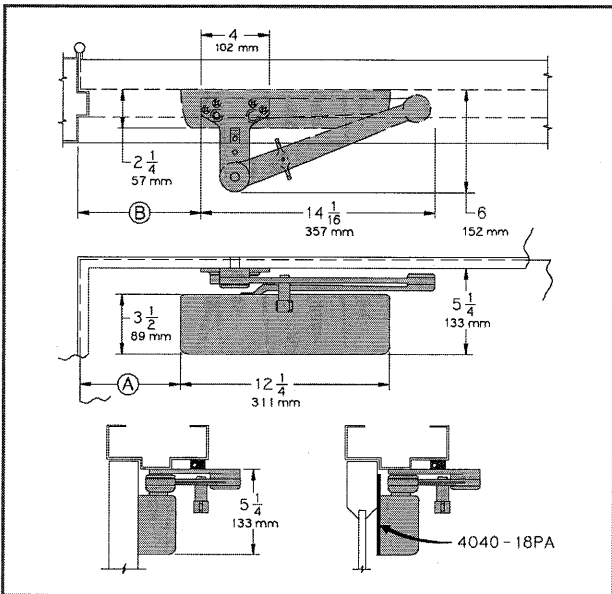
- ▶ **Butt Hinges** should not exceed 5" (127 mm) in width.
- ▶ **Auxiliary Stop** is recommended at hold-open point, where the door cannot swing 180°, or where CUSH-N-STOP arm is not used.
- ▶ **Clearance** for 4040-62PA shoe is 4" (102 mm) from door face. EDA shoe projects 5 1/2" (140 mm) from door face. CUSH shoe projects 6" (152 mm) from door face.
- ▶ **Top Rail** less than 5 3/8" (137 mm) measured from the stop requires PLATE, 4040-18PA. Plate requires 2" (51 mm) minimum from the stop. With Designer Series metal cover, use PLATE, 4040-18PADS1
- ▶ **Head Frame** flush or rabbeted requires PA SHOE ADAPTER, 4040-418.
- ▶ **Stop Width** minimum 1" (25 mm).
- ▶ **Blade Stop** clearance requires 1/2" (13mm) BLADE STOP SPACER, 4040-61.
- ▶ **Delayed Action** (not available on 4040XP) Add suffix "DEL" to selected cylinder (eg. P4041 DEL). Delays time adjustable up to approximately 1 minute.

MOUNTING DETAILS

## 4040 SERIES EDA MOUNT



## 4040 SERIES CUSH MOUNT



- ▶ **Clearance** for 4040-62EDA is 5 1/2" (140 mm) from door face. 6" (152 mm) for CUSH.
- ▶ **Head Frame** flush or rabbeted requires CUSH FLUSH PANEL ADAPTER, 4040-419.
- ▶ **CUSH ARM** requires SHOE SUPPORT, 4040-30 for fifth screw anchorage for narrow frames.
- ▶ **Delayed Action** (not available on 4040XP) Add suffix "DEL" to selected cylinder (eg. 4041 DEL). Delays closing from maximum opening to; 115° with 180° template. 95° with 110° template. 85° with 100° template. 75° with 90° template. Delay time adjustable up to approximately 1 minute.

## LCN 4040 SERIES

Mounting details are the same as 4040 Series REGULAR or HOLD-OPEN except as listed below. 4040 Series closers ordered with EDA or CUSH arms include 4040-201 FIFTH HOLE SPACER to support the shoe.

## MAXIMUM OPENING

EDA arm can be templated for points at: 110°,

$$\textcircled{A} = 6 \frac{3}{8}" (162 \text{ mm})$$

$$\textcircled{B} = 7 \frac{3}{4}" (197 \text{ mm})$$

or 180°.

$$\textcircled{A} = 2 \frac{7}{8}" (73 \text{ mm})$$

$$\textcircled{B} = 4 \frac{1}{4}" (108 \text{ mm})$$

Hold-open points up to maximum opening with HEDA arm.

CUSH arms can be templated for opening/hold-open point at: 85°,

$$\textcircled{A} = 7 \frac{15}{16}" (202 \text{ mm})$$

$$\textcircled{B} = 9 \frac{1}{8}" (232 \text{ mm})$$

90°,

$$\textcircled{A} = 7 \frac{3}{16}" (183 \text{ mm})$$

$$\textcircled{B} = 8 \frac{1}{2}" (216 \text{ mm})$$

100°,

$$\textcircled{A} = 6 \frac{1}{16}" (154 \text{ mm})$$

$$\textcircled{B} = 7 \frac{1}{4}" (184 \text{ mm})$$

or 110°.

$$\textcircled{A} = 5 \frac{1}{16}" (129 \text{ mm})$$

$$\textcircled{B} = 6 \frac{3}{8}" (162 \text{ mm})$$

Spring Cush dead stop points are approximately 5° more than templated stop point. Hold open at templated stop points.

# LCN 4040 SERIES

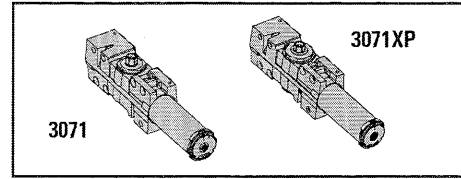
## CYLINDERS

### CYLINDER, 4041-3071

Standard, non-handed cast iron cylinder assembly.

### CYLINDER, 4040XP-3071

Heavy duty, non-handed cast iron cylinder assembly.



## COVERS

### COVER, 4040-72

Standard, non-handed plastic clip-on cover.

### METAL COVER, 4040-72MC

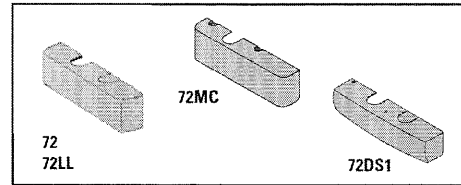
Optional, handed cover. Required for plated finishes and custom powder coat finishes.

### LEAD LINED COVER, 4040-72LL

Optional non-handed plastic clip-on cover.

### DESIGNER SERIES METAL COVER, 4040-72DS1

Optional, non-handed designer series metal cover.



## ARMS

### REGULAR ARM, 4040-3077

Non-handed arm mounts pull side or top jamb with shallow reveal. P4041 closer includes PA SHOE, 4040-62PA required for parallel arm mounting.

### PA SHOE, 4040-62PA

Required for parallel arm mounting.

### LONG ARM, 4040-3077L

Optional non-handed arm includes LONG ROD AND SHOE, 4040-79LR for top jamb mount.

### EXTRA LONG ARM, 4040-3077ELR

Optional non-handed arm includes EXTRA LONG ROD AND SHOE, 4040-79ELR for top jamb mount with deep reveal.

### HOLD-OPEN ARM, 4040-3049

Optional, non-handed arm mounts pull side or top jamb with shallow reveal, hold-open adjustable shoe. P4041 closer includes 4040-62PA shoe required for parallel arm mounting.

### LONG HOLD-OPEN ARM, 4040-3049L

Optional non-handed arm includes LONG HEAD AND TUBE, 4040-3048L for top jamb mount.

### EXTRA DUTY ARM, 4040-3077EDA

Non-handed parallel arm features forged, solid steel main and forearm for potentially abusive installations.

### HOLD-OPEN EXTRA DUTY ARM, 4040-3049EDA

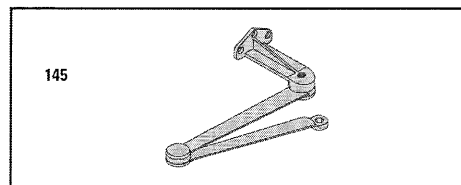
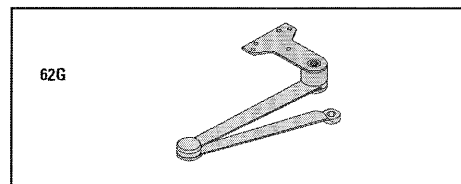
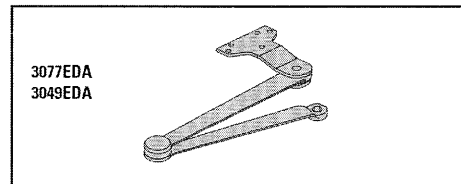
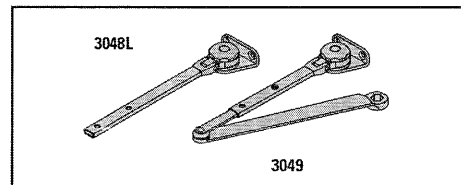
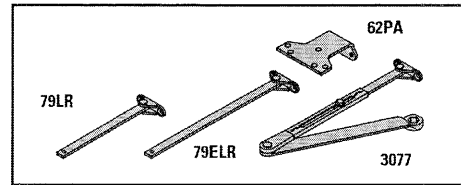
Optional handed arm provides hold-open function, adjustable at the shoe.

### THICK HUB SHOE, 4040-62G

Optional for blade stop clearance, requires special templating.

### FLUSH TRANSOM SHOE, 4040-145

Optional for single rabbetted installations, requires special templating.



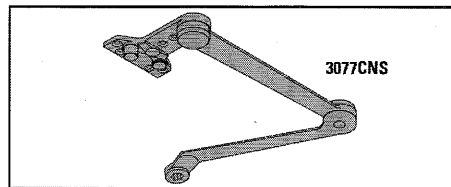
ACCESSORIES

# LCN 4040 SERIES

## ARMS cont.

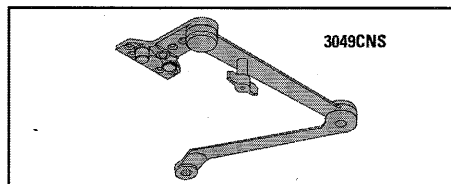
### CUSH-N-STOP® ARM, 4040-3077CNS

Optional, non-handed parallel arm features solid forged steel main arm and forearm with stop in soffit shoe.



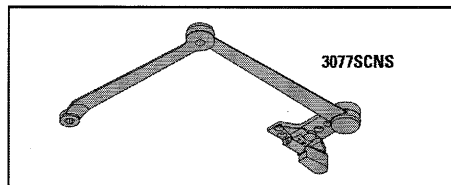
### HCUSH ARM, 4040-3049CNS

Provides hold-open function with templated stop/hold-open points. Handle controls hold-open function.



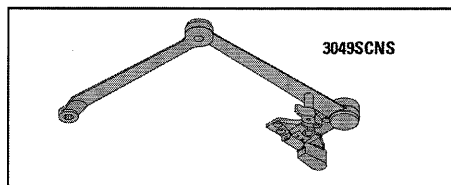
### SPRING CUSH ARM, 4040-3077SCNS

Optional, non-handed parallel arm for abusive applications features solid forged steel main arm and forearm with spring loaded stop in the soffit shoe.



### SPRING HCUSH ARM, 4040-3049SCNS

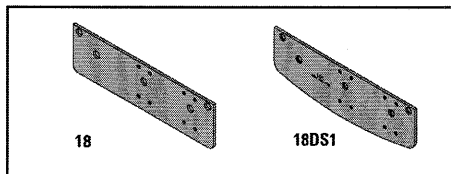
Optional, non-handed parallel arm for abusive applications features solid forged steel main arm and forearm with spring loaded stop in the soffit shoe. Handle controls hold-open function.



## INSTALLATION ACCESSORIES

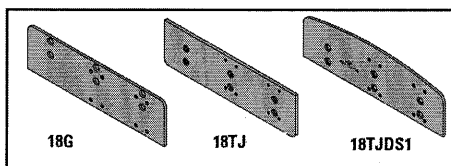
### PLATE, 4040-18/4040-18DS1

Required for hinge side mount where top rail is less than 3 3/4" (95 mm). Plate requires minimum 2" (51 mm) minimum top rail. With Designer Series metal cover, use PLATE, 4040-18DS1



### PLATE, 4040-18G

Locates top jamb mounted closer flush with top of head frame face in flush ceiling condition. Plate requires 1 3/4" (44 mm) minimum head frame.

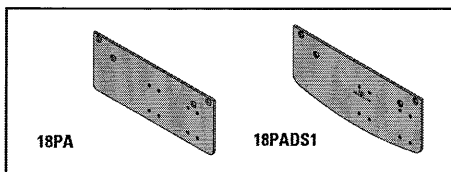


### PLATE, 4040-18TJ/4040-18TJDS1

Centers top jamb mounted closer vertically on head frame where face is less than 3 1/2" (89 mm). Plate requires 1 3/4" (44 mm) minimum head frame. With Designer Series metal cover, use PLATE, 4040-18TJDS1

### PLATE, 4040-18PA/4040-18PADS1

Required for parallel arm mounting where top rail is less than 5 1/2" (140 mm), measured from the stop. Plate requires 2" (51 mm) minimum top rail. With Designer Series metal cover, use PLATE, 4040-18PADS1



# LCN 4040 SERIES

## INSTALLATION ACCESSORIES cont.

### CORNER BRACKET, 4040-17

Designed to lower closer for clearance of certain auxiliary holders (consult factory).

### CORNER BRACKET, 4040-16

For doors where top jamb or parallel arm mounting cannot be used (consult factory).

**CUSH SHOE SUPPORT, 4040-30** provides anchorage for fifth screw used with CUSH arms, where reveal is less than 3 1/16" (78 mm).

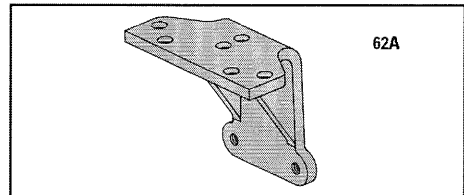
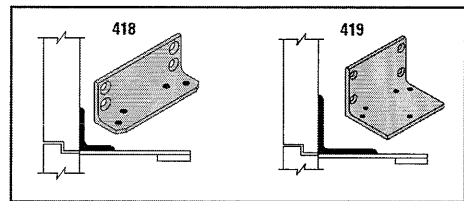
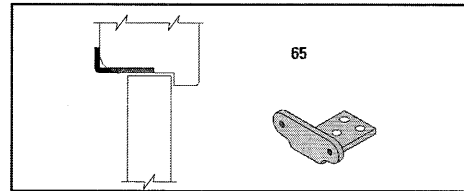
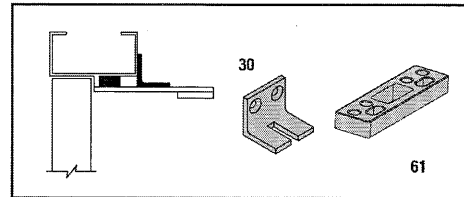
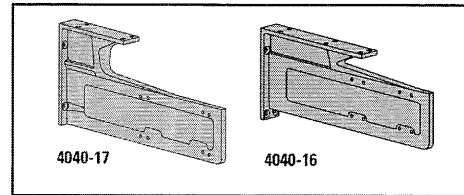
**BLADE STOP SPACER, 4040-61** required to lower parallel arm shoe to clear 1/2" (13 mm) blade stop.

**SOFFIT SHOE, 4040-65** adapts hinge side shoe to rounded or bull nose trim.

**PA SHOE ADAPTER, 4040-418** provides horizontal mounting surface for parallel arm shoe on single rabbeted or flush frame.

**CUSH FLUSH PANEL ADAPTER, 4040-419** provides horizontal mounting surface for CUSH shoe on single rabbeted or flush frame.

**AUXILIARY SHOE, 4040-62A** requires a top rail of 7" (178 mm). Optional shoe replaces -62PA for parallel arm mounting of regular arm with overhead holder/stop.



ACCESSORIES



# LCN 4040 SERIES

ORDERING INFORMATION

## TABLE OF SIZES

4041 cylinders are adjustable from size 1 through size 6 and is shipped set to size 3.

Closing power of 4040 series closers may be adjusted 50%.

→ Indicates recommended range of door width for closer size.

### EXTERIOR (and VESTIBULE) DOOR WIDTH

	24" 610mm	30" 762mm	36" 914mm	42" 1067mm	48" 1219mm
	size 3	size 4	size 5	size 6	
*4041	→				
Minimum Door Width					


### INTERIOR DOOR WIDTH

	24" 610mm	34" 864mm	38" 965mm	48" 1219mm	54" 1372mm	60" 1524mm
	size 2	size 3	size 4	size 5	size 6	
*4041	→					
Minimum Door Width	* Adjustable Size 1 thru 6					

## REDUCED OPENING FORCE 4040 SERIES CLOSERS

**CAUTION!** Any manual door closer, including those certified by BHMA to conform to ANSI Standard A156.4, that is selected, installed and adjusted based on ADA or other reduced opening force requirements may not provide sufficient power to reliably close and latch a door.

Refer to POWER OPERATORS section for information on systems that meet reduced opening force requirements without effecting closing power.

	DOOR WIDTH	36"	42"	48"
	8.5* lbs.	4041	4041	4041
5.0* lbs.	4041	4041	4041	

\* Maximum opening force

## HOW-TO-ORDER 4041 SERIES CLOSERS

### 1. SELECT FINISH

- Standard Powder Coat \_\_\_\_\_  
Aluminum, Dark Bronze, Tan, Statuary, Light Bronze, Black, Brass.

**Closer will be shipped with:**  
 - STANDARD CLIP ON COVER,  
 - REGULAR ARM,  
 - SELF-REAMING and TAPPING SCREWS,  
 unless options listed below are selected.

### CLOSER OPTIONS

#### CYLINDER

- Delayed Action (DEL)

#### COVER

- Lead Lined (LL)
- Metal (specify right or left hand) (MC)
- Designer Series Metal (non-handed) (DS1)

#### FINISH

- Custom Powder Coat (RAL) \_\_\_\_\_  
(handed metal cover required)
- Plated Finish, US \_\_\_\_\_  
(handed metal cover required)
- SRI primer

#### ARM

- Regular w/62PA (Rw/PA)
- Regular w/62A (R/62A)
- Long (LONG)
- Extra Long (XLONG)
- Hold-Open (H)
- Hold-Open w/62PA (Hw/PA)
- Long Hold-Open (HLONG)
- EDA (optional -62G or -145)
- HEDA (specify right or left hand, optional-62G or -145)
- Cush-N-Stop (CUSH)
- HCush-N-Stop (HCUSH)
- Spring Cush (SCUSH)
- Spring HCush (SHCUSH)

#### OPTIONAL SCREW PACKS

- TB\* w/Self-Reaming and Tapping (TBSRT)
- Wood & Machine Screw (WMS)
- TB\*, Wood & Machine Screw (TBWMS)
- TORX Machine Screw (TORX)
- TB\* & TORX Machine Screw (TBTRX)
- \* Specify door thickness if other than 1 3/4".

#### INSTALLATION ACCESSORIES

- Plate, 4040-18
- Plate, 4040-18TJ
- Plate, 4040-18G
- Plate, 4040-18PA
- Plate, 4040-18DS1
- Plate, 4040-18TJDS1
- Plate, 4040-18PADS1
- CUSH Shoe Support, 4040-30
- Blade Stop Spacer, 4040-61
- Auxiliary Shoe, 4040-62A
- Soffit Shoe, 4040-65
- PA Shoe Adapter, 4040-418
- CUSH Flush Panel Adapter, 4040-419

#### SPECIAL TEMPLATE

- ST- \_\_\_\_\_



# National Guard Products, Inc.

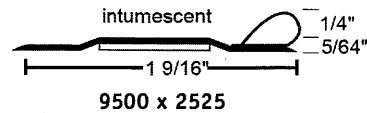
PROTECTION, INSIDE OUT

Toll Free Phone 1-800-647-7874

Toll Free Fax 1-800-255-7874

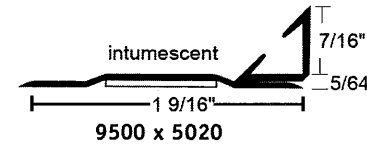
Positive Pressure Solutions

**9500 x 5020 or 9500 x 2525**  
**NGP "EDGE", Self-Adhesive Fire**  
**Seal x Smoke Seal**



**20, 45, 60, 90 Minute rated**  
**wood door with steel or wood fire door**  
**frames up to:**

single swing 4'0 x 9'0, perimeter  
 standard pair 8'0 x 9'0, perimeter/with  
 9500 and choice of 115N, 125N, 9115,  
 9125, 9600, 9605 astragal seal  
 at the meeting edge



1/8" clearance required between door and frame



**Order separately:**  
 9500 Gray  
 9500DKB Brown



**5020B Brown**  
**5020C Charcoal**  
**5020W White**



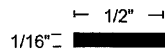
**2525B Brown**  
**2525C Charcoal**  
**2525W White**  
**2525T Tan**

Available in 36", 48",  
 84" 96" and 108" lengths.

Available  
 in 36", 48", 84",  
 96" and 108" lengths

Available  
 in 17', 20', 21',  
 25' and 300' rolls

**9800B Brown**  
**9800C Charcoal**  
**9800W White**  
 Available in 17', 21'  
 and 150' rolls



**9890C Charcoal**  
 Available per foot

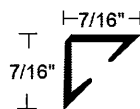


**9800 x 5020 or 9800 x 5050**  
**Self-Adhesive Intumescent Fire Seal x Smoke Seal**

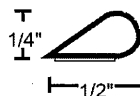
**20, 45, 60 Minute rated wood door**  
**with steel or wood fire-rated door**  
**frames up to:**

single swing 4'0 x 9'0, perimeter  
 standard pair 8'0 x 9'0, perimeter/ use 9500 or  
 9890 at meeting edge  
 and choice of 115N, 125N, 9115, 9125,  
 9600, 9605 astragal seal

**5020B Brown**  
**5020C Charcoal**  
**5020W White**  
 Available in 36", 48", 84", 96"  
 and 108" lengths



**5050B Brown**  
**5050C Charcoal**  
**5050T Tan**  
**5050W White**  
**5050CL Clear**  
 Available in 17', 20', 21', 25'  
 and 300' rolls



**9890 x 5020 or 9890 x 5050**  
**Self-Adhesive Fire Seal x Smoke Seal**

**90 Minute rated wood door with steel fire-rated door**  
**frames up to:**

single swing 4'0 x 8'0, perimeter  
 standard pair 8'0 x 8'0, perimeter/ use 9500 or  
 9890 at meeting edge  
 and choice of 115N, 125N, 9115, 9125,  
 9600, 9605 astragal seal



**Note: 9500, 9800, 9890 Fire seals may also be combined with any Smoke and Draft Control Gasketing shown on pages 10 & 11.**



# National Guard Products, Inc.

PROTECTION, INSIDE OUT

Toll Free Phone 1-800-647-7874

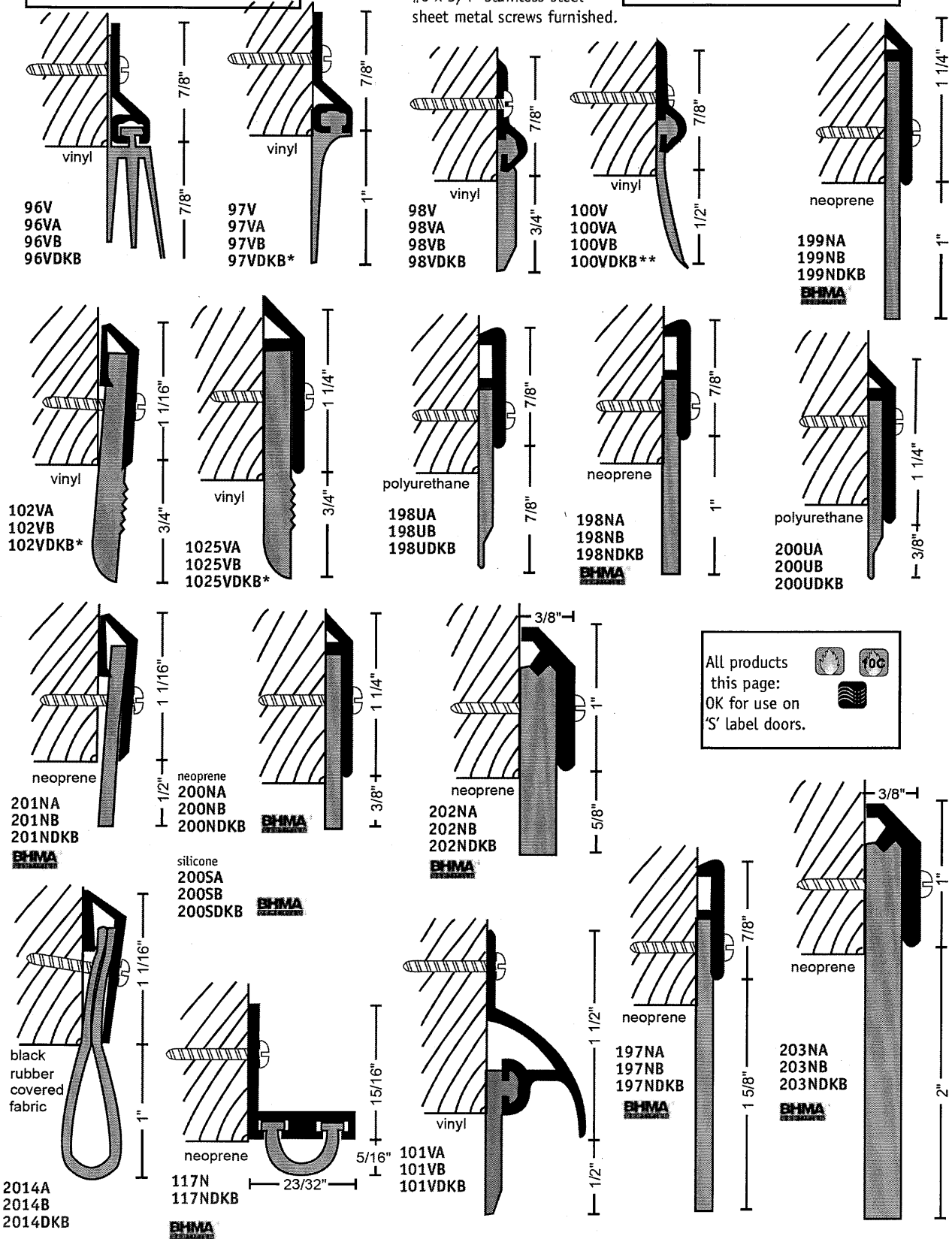
Toll Free Fax 1-800-255-7874

Sweeps


vinyl is gray. Exceptions:  
\*vinyl is black, \*\* vinyl is brown

neoprene, polyurethane are black  
silicone is gray

#6 x 3/4" stainless steel  
sheet metal screws furnished.



All products  
this page:  
OK for use on  
'S' label doors.



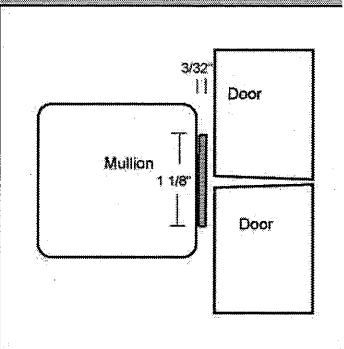
**NGP**  
National Guard Products

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**Catalog**

<b>NGP Catalog Number</b>	5100-96
<b>Description</b>	Mullion Seal
<b>Width</b>	1 1/8"
<b>Height</b>	3/32"
<b>Price</b>	RL
<b>Comments</b>	Neoprene seal with self-adhesive strip

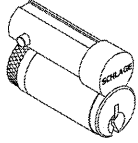


**Mullion**  
1 1/8"  
3/32"  
Door  
Door

[<< BACK](#)

# CYLINDERS, KEYS AND KEY CONTROL

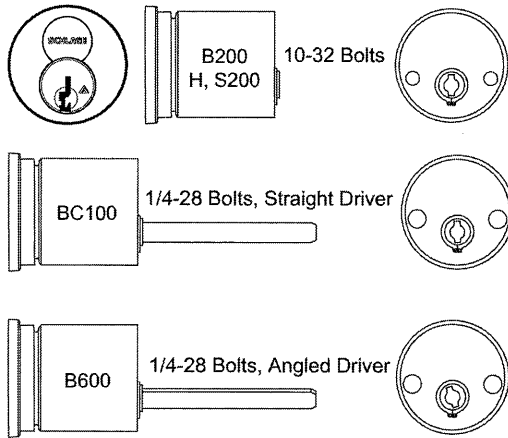
## Full Size Interchangeable Core Cylinders for Schlage Locksets



### Full Size Core Only

Number	Mechanism
23-030	Conventional core
30-120	Conventional core for hotel function (specify hand)
20-740	Primus core (not available in hotel function)

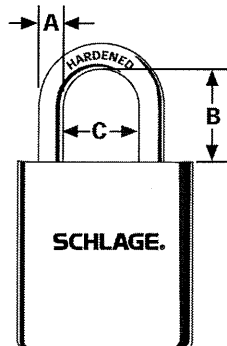
Available 606 and 626 finish only. Everest C123 keyway standard.  
Order control keys separately.



### Full Size IC Housing for Bored Deadlocks, Less Core

Lockset Series	Description	Number	Specify Finish
BC100-Series	Outside	B220-203	605, 609, 612, 613, 625, 626
	Inside	B220-204	See Note Below
B250, H, S200-Series	Outside	22-061	605, 606, 609, 610, 611, 612, 613, 616, 625, 626
	Inside of B252	22-062	
B600 / 700-Series	Outside	B610-027	605, 606, 609, 612, 613, 625, 626
	Inside	B610-028	See Note Below

Specify finish of B610-031 inside snap-on faceplate ordered separately for BC162 and B662/762.

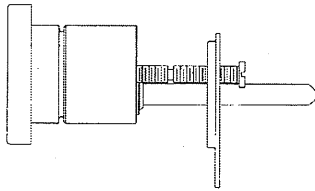
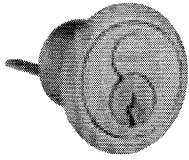


### Interchangeable Core Padlocks

Padlock Series	Shackle Dimensions			Padlock with Core	
	A	B	C	Conventional	Primus
PL4000 2" x 2¼" x 7/8"	¾"	1 1/8"	¾"	PL4001	PL4741
	¾"	2"	¾"	PL4002	PL4742
	¾"	3"	¾"	PL4003	PL4743

# CYLINDERS, KEYS AND KEY CONTROL

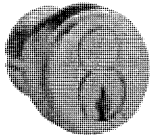
## *Full Size Interchangeable Core Cylinders for Exit Devices, Aluminum Doors, etc.*



### Interchangeable Core Rim Cylinders for Exit Devices

Number	Core Mechanism
20-057	Conventional core
20-757	Primus core
20-079	Housing only, less core

Available 605, 606, 612, 613, 625 and 626 finish.  
Everest C123 keyway standard.



### Cylinders for Adams Rite MS and 4700 Series Lori 4500 Series and Corbin Russwin DL3000 Series

Number	Core Mechanism	Collar
26-098	Conventional core	Compression ring & spring
20-062	Conventional core	$\frac{3}{16}$ " + $\frac{3}{8}$ " blocking rings
20-766	Primus core	$\frac{3}{16}$ " + $\frac{3}{8}$ " blocking rings
20-060	Housing less core	None

These cylinders include set screw pack B220-050 for Adams Rite locks.



**K510-711**  
Adams Rite  
MS Cam

### Cylinders for Adams Rite 4070 Series Deadlocks

Number	Core Mechanism	Collar
20-091	Conventional core	$\frac{3}{16}$ " + $\frac{3}{8}$ " blocking rings
20-722	Primus core	$\frac{3}{16}$ " + $\frac{3}{8}$ " blocking rings
20-090	Housing less core	None

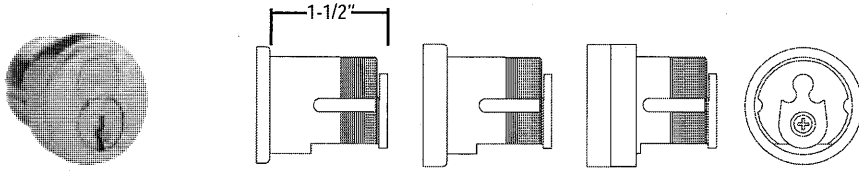


**B520-378**  
Adams Rite  
4070 Cam



- Notes
1. Mortise cylinders available 605, 606, 612, 613, 625, and 626 finish. Cores furnished 606 and 626 only.
  2. To differentiate between Classic and Everest, specify keyway. Example: C or CP (Classic), C123 (Everest). Everest C123 keyway standard.
  3. All cylinders are 1 1/2" long.
  4. Specify LKB if 0-bitted Primus cylinders are required less key blanks.

# CYLINDERS, KEYS AND KEY CONTROL

## Full Size Interchangeable Core Mortise Cylinders



### Cylinders for Schlage L-Series Mortise Locks

Design	Function	Core Mechanism		
		Conventional	Primus	Housing Less Core
 <b>L &amp; N Escutcheons</b> (cylinders with compression ring)	All Except Below	30-008	20-798	30-007
	L9060P Outside	30-030	20-782	30-032 + 36-083
	L9485P, L9486P Hotel Functions	30-010*	N/A	30-007
 <b>Sectional Trim</b> (cylinder with compression ring, spring and 3/8" blocking ring)	All Except Below	30-138	20-776	30-137
	L9060P Outside	20-061	20-783	30-032 + 36-083 + 35-082-037
	L9485P, L9486P Hotel Functions	30-140*	N/A	30-137



**L583-255**  
Cam for All Functions Except L9060 Outside



**K510-680**  
Cam for L9060 Outside

\* Hotel function cores are handed. Specify hand of door.

### Mortise Cylinders with Straight Cam for Exit Devices and Most Old Black Cast Iron Mortise Locksets

Number	Core Mechanism	Collar
26-091	Conventional core	Compression ring & spring
20-061		3/16" + 3/8" blocking rings
20-763	Primus core	Compression ring & spring
20-771		3/16" + 3/8" blocking rings
20-059	Housing less core	None
26-064		Compression ring & spring
26-094		3/16" + 3/8" blocking rings



**K510-730**  
Straight Cam,  
Other Applications

- Notes
1. Available 605, 606, 612, 613, 625, and 626 finish. Cores furnished 606 and 626 only.
  2. To differentiate between Classic and Everest, specify keyway. Example: C or CP (Classic), C123 (Everest). Everest C123 keyway standard.
  3. All cylinders are 1-1/2" long.
  4. Specify LKB if 0-bitted Primus cylinders are required less key blanks.

## Specifications

**Handing:**

All D-Series lever locksets are non-handed.

**Door Thickness:**

1 $\frac{3}{8}$ " to 2 $\frac{1}{8}$ " (41mm–54mm) standard including Vandlgard® functions. 1 $\frac{3}{4}$ " - 2" for function D85. See accessories (Page 11) for spacers required for 1 $\frac{3}{8}$ " doors.

**Backset:**

2 $\frac{3}{4}$ " (70 mm) standard. 2 $\frac{3}{8}$ ", 3 $\frac{3}{4}$ " and 5" (60mm, 95 mm, 127 mm) optional.

**Faceplate:**

Brass, bronze or stainless steel. 1 $\frac{1}{8}$ " x 2 $\frac{1}{4}$ " (29 mm x 57mm) square corner, beveled.

**Lock Chassis:**

Zinc plated for corrosion resistance.

**Latch Bolt:**

Steel,  $\frac{1}{2}$ " (12mm) throw, deadlocking on keyed and exterior functions.  $\frac{3}{4}$ " (19mm) throw anti-friction latch available for pairs of fire doors.

**Exposed Trim:**

Levers: Pressure cast zinc, plated to match finish symbols.  
Roses: Solid brass.

**Strike:**

ANSI curved lip strike 1 $\frac{1}{4}$ " x 4 $\frac{7}{8}$ " x 1 $\frac{3}{16}$ " lip to center standard. Optional strikes, lip lengths and ANSI strike box available. See page 10.

**Cylinder & Keys:**

6-pin Everest C123 keyway standard with two patented nickel silver keys per lock.

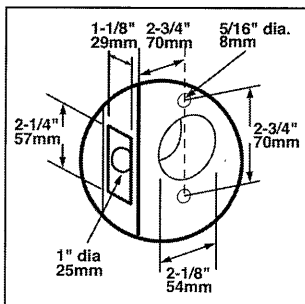
**Keying Options:**

Interchangeable core and Primus® high security cylinders. Master keying, grand master keying and construction keying.

**Warranty:**

Seven-year limited for all functions including Vandlgard®.

## Door Preparation

**Lever Designs**

## Certifications

**ANSI**

Meets or exceeds A156.2 Series 4000, Grade 1 strength and operational requirements. Meets A117.1 Accessibility Code.

**Federal**

Meets FF-H-106C Series 161.

**California State Reference Code (CSFH)**

(Formerly Title 19, California State Fire Marshal Standard)

All levers with less than  $\frac{1}{2}$ " (64mm) returns comply; levers return to within  $\frac{1}{2}$ " of door face.

**MEA Certification**

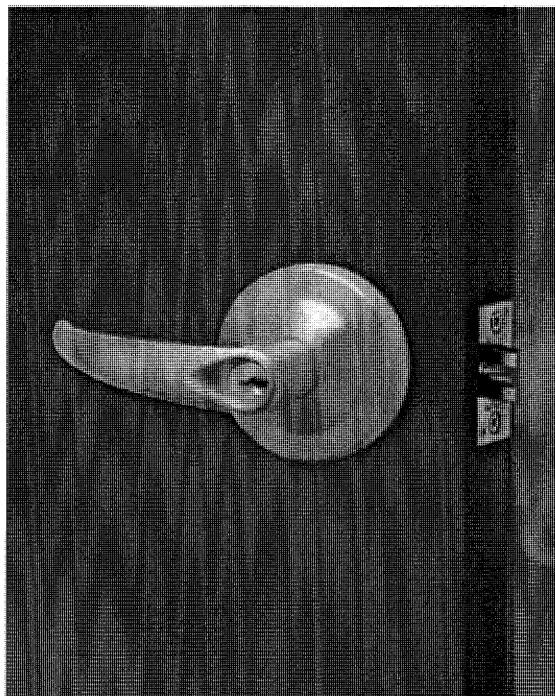
All electrified locking (fail-safe, unlocked by switch or power failures) functions accepted for use in New York City by the City of New York, Department of Buildings (MEA 24-04-E).

All levers with less than  $\frac{1}{2}$ " (64mm) returns comply with California Fire Safety Codes.

3/4" and 1/2" throw latch approved for Hurricane Resistance with Miami-Dade County, Florida and the Florida Building Commission.

**UL / cUL:**

All locks listed for A label single doors, 4' x 8'. Letter F and UL symbol





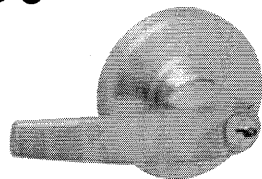
# D SERIES LEVERS

## Lever Designs & Finishes

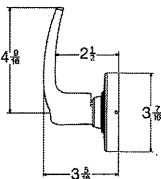


### ATHENS

Symbol: ATH (L-Series 07)  
 Material: Pressure cast zinc lever; wrought brass rose  
 Finishes:  
 605, 606, 612, 613, 619, 625, 626

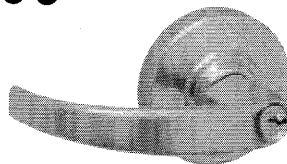


606

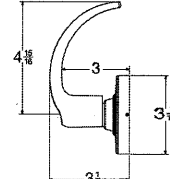


### SPARTA

Symbol: SPA (L-Series 17)  
 Material: Pressure cast zinc lever; wrought brass rose  
 Finishes:  
 605, 606, 612, 613, 619, 625, 626

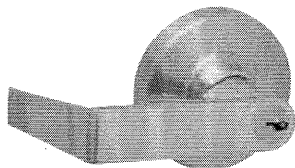


626

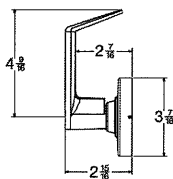


### RHODES

Symbol: RHO (L-Series 06)  
 Material: Pressure cast zinc lever; wrought brass rose  
 Finishes:  
 605, 606, 612, 613, 619, 625, 626

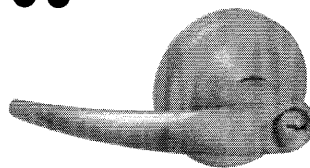


612

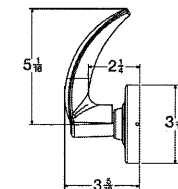


### OMEGA

Symbol: OME (L-Series Omega)  
 Material: Pressure cast zinc lever; wrought brass rose  
 Finishes:  
 605, 606, 612, 613, 619, 625, 626

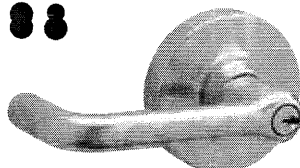


619

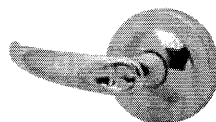
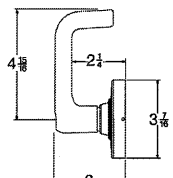


### TUBULAR (L-Series 03)

Symbol: TLR  
 Material: Pressure cast zinc lever; wrought brass rose  
 Finishes:  
 605, 606, 612, 613, 619, 625, 626



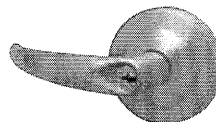
626



605  
Bright Brass



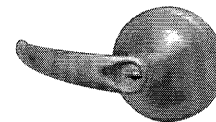
606  
Satin Brass



612  
Satin Bronze



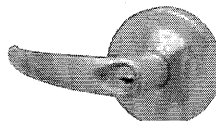
613  
Oil Rubbed  
Bronze



619  
Satin Nickel



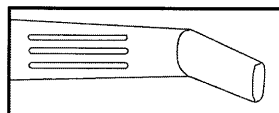
625  
Bright Chromium  
Plated



626  
Satin Chromium  
Plated

Keyed functions available with Full Size Interchangeable Core options.

Keyed functions available with Small Format Interchangeable Core options.



### TACTILE WARNING (KNURLING)

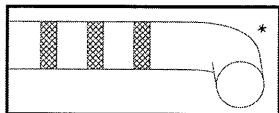
Change symbol designation as follows:

**8AT** for Athens

**8RO** for Rhodes

**8SP** for Sparta

**8TR** for Tubular\*



\*Only available with Tubular lever.

Only outside lever is knurled unless otherwise specified.

Not available with Omega trim

Extended Factory Lead Time

### Finishes

605 Bright Brass

606 Satin Brass

612 Satin Bronze

613 Oil Rubbed Bronze

619 Satin Nickel

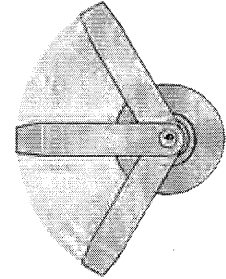
625 Bright Chromium Plated

626 Satin Chromium Plated

# D-SERIES WITH VANDLGARD™

Schlage D-Series keyed lever locks with Vandlgard provide vandal resistant technology. Designed for maximum accessibility, security and durability, Vandlgard sets the standard for door hardware in educational facilities and other applications subject to heavy traffic or abuse. The unique features of Vandlgard prevent damage to internal lock components caused by excessive force from persons kicking, hitting or standing on the lever to gain access. Vandlgard functions maintain total key system and architectural design compatibility with Schlage's regular D-Series cylindrical locks.

Levers have virtually replaced knobs in the marketplace for handicap accessibility. The added grip and leverage has created an increased opportunity for abuse or vandalism. This abuse often renders locks inoperable. In some cases the security of the door is violated leaving computer and laboratory equipment susceptible to theft. While this type of abuse is commonly associated with junior and senior high schools, it also occurs in universities, office buildings, commercial buildings, and public buildings.



Locked lever freely rotates up and down while remaining securely locked. The Vandlgard function also increases resistance to over-rotation of the lever.

## *Benefits & Features*

### *Superb warranty.*

*All Vandlgard functions have a 7-year warranty.*

### *Reduce lever wobble and play.*

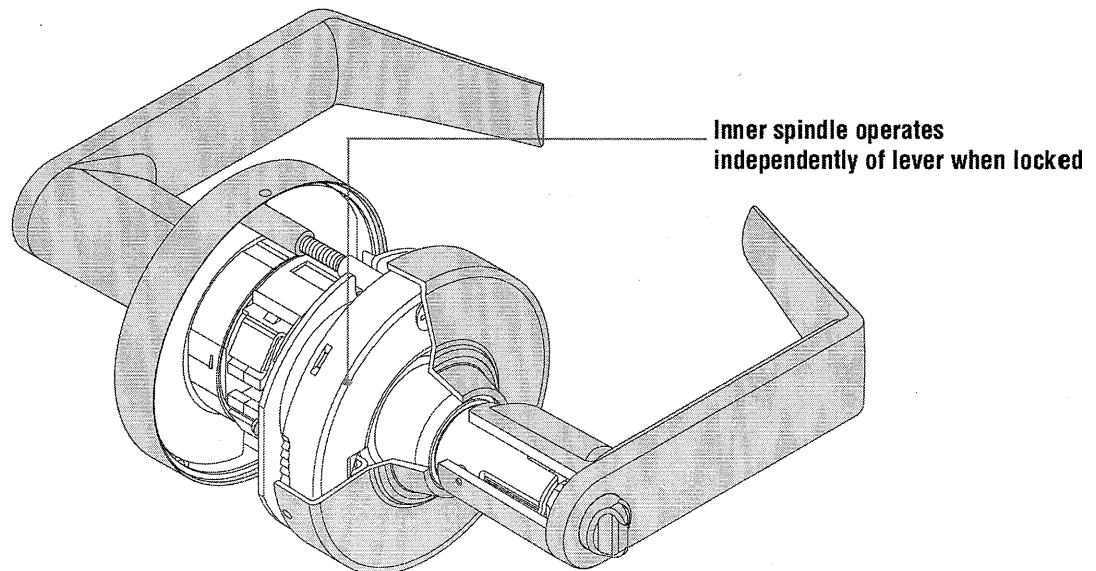
*Integrated spindle and spring cage greatly reduces lever sag and wobble.*

### *Resists vandalism.*

*Free-wheeling lever eliminates the ability to stand or exert excessive force on the end of the lever.*

### *Ease of installation.*

*Installs in under 2 minutes.*



*D-Series Vandlgard levers comply with ADA requirements. ♿*

# D SERIES LEVERS

## Functions

### ANSI A156.2 Series 4000 Grade 1

#### Non-Keyed Locks

SCHLAGE ANSI

ND10S F75

#### Passage Latch

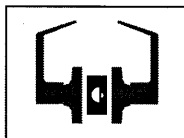
Both levers always unlocked. Inside lever is always free for immediate egress.



ND12D F89

#### Exit Lock

Outside lever always fixed. Inside lever always unlocked. Inside lever is always free for immediate egress.



ND12DEL

#### Electrically Locked (Fail Safe)

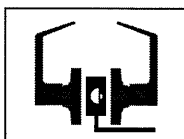
Outside lever continuously locked electrically. Unlocked by switch or power failure. Auxiliary latch deadlocks latchbolt when door is closed. Inside lever always free for immediate exit. Inside lever is always free for immediate egress.



ND12DEU

#### Electrically Unlocked (Fail Secure)

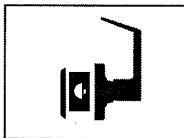
Outside lever continuously locked until unlocked by electric current. Auxiliary latch deadlocks latchbolt when door is closed. Inside lever always free for immediate exit. Inside lever is always free for immediate egress.



ND25D

#### Exit Lock

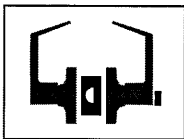
Blank plate outside. Inside lever always unlocked. Inside lever is always free for immediate egress.



ND40S F76

#### Bath/Bedroom Privacy Lock

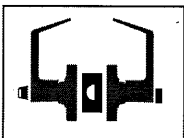
Push-button locking. Can be opened from outside with small screwdriver. Turning inside lever or closing door releases button. Inside lever is always free for immediate egress.



ND44S

#### Hospital Privacy Lock

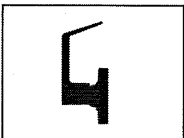
Push-button locking. Unlocked from outside by turning emergency turn-button. Turning inside lever or closing door releases button. Inside lever is always free for immediate egress.



ND170

#### Single Dummy Trim

Dummy trim for one side of door. Used for door pull or as matching inactive trim. Inside lever is always free for immediate egress.



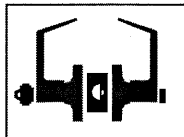
#### Keyed Locks

SCHLAGE ANSI

ND50PD F82

#### Entrance/Office Lock †

Push-button locking. Push-button locks outside lever until unlocked with key or by turning inside lever. Inside lever is always free for immediate egress.



ND53PD F109

#### Entrance Lock †

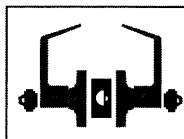
Turn/push-button locking; pushing and turning button locks outside lever, requiring use of key until button is manually unlocked. Push-button locking; pushing button locks outside lever until unlocked by key or by turning inside lever. Inside lever is always free for immediate egress.



ND60PD F88

#### Vestibule Lock †

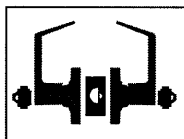
Latch retracted by key from outside when outside lever is locked by key in inside lever. Inside lever is always unlocked. Inside lever is always free for immediate egress.



ND66PD F91

#### Store Lock † \*

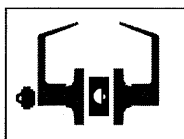
Key in either lever locks or unlocks both levers.



ND70PD F84

#### Classroom Lock †

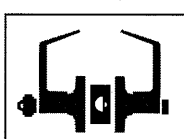
Outside lever locked and unlocked by key. Inside lever always unlocked. Inside lever is always free for immediate egress.



ND73PD F90

#### Corridor Lock †

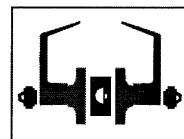
Locked or unlocked by key from outside. Push-button locking from inside. Turning inside lever or closing door releases button. When outside lever is locked by key it can only be unlocked by key. Inside lever is always unlocked. Inside lever is always free for immediate egress.



ND75PD

#### Classroom Security Lock †

Key in either lever locks or unlocks outside lever. Inside lever is always unlocked. Inside lever is always free for immediate egress.



#### Safe School Locks

† Keyed functions available with 6-pin (PD/LD), SFIC(GD/BD), or FSIC(RD/JD) cylinder.

\* Caution: Double cylinder locks on residences and any door in any structure which is used for egress are a life safety hazard in times of emergency and their use is not recommended. Installation should be in accordance with existing codes only.

# D SERIES LEVERS

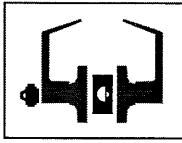
## Functions

### ANSI A156.2 Series 4000 Grade 1

#### Keyed Locks

SCHLAGE ANSI

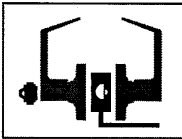
ND80PD F86



#### Storeroom Lock †

Outside lever fixed. Entrance by key only. Inside lever always unlocked. Inside lever is always free for immediate egress.

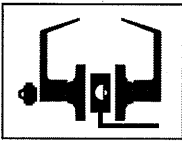
ND80PDEL



#### Electrically Locked (Fail Safe) †

Outside lever continuously locked electrically. Unlocked by key outside or by switch or power failure. Auxiliary latch deadlocks latchbolt when door is closed. Inside lever always free for immediate exit. Inside lever is always free for immediate egress.

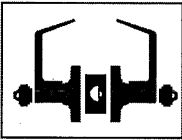
ND80PDEU



#### Electrically Unlocked (Fail Secure) †

Outside lever continuously locked until unlocked by key or electric current. Auxiliary latch deadlocks latchbolt when door is closed. Inside lever always free for immediate exit. Inside lever is always free for immediate egress.

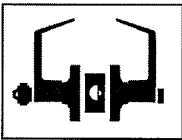
ND82PD F87



#### Institution Lock † \*

Both levers fixed. Entrance by key in either lever.

ND85PD



#### Faculty Restroom Lock \*\*

Outside lever fixed. Entrance by key only. Push-button in inside lever activates visual "occupancy" indicator, allowing only emergency master key to operate. Turning inside lever or closing door releases visual occupancy indicator. Rotation of inside spinner-button provides lock-out feature by keeping indicator thrown. Inside lever is always free for immediate egress.

#### Safe School Locks

† Keyed functions available with 6-pin (PD/LD), SFIC(GD/BD), or FSIC(RD/JD) cylinders.

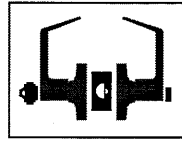
\* **Caution:** Double cylinder locks on residences and any door in any structure which is used for egress are a life safety hazard in times of emergency and their use is not recommended. Installation should be in accordance with existing codes only.

\*\* 85 function locks are not available in Full Size & Small Format Interchangeable Cores.

### Vandlgard Functions

SCHLAGE ANSI

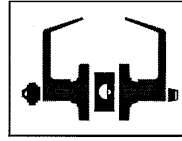
ND91PD F82



#### Entrance/Office Lock †

Push-button locking. Push-button disengages outside lever until unlocked with key or by turning inside lever. Vandlgard is designed to disengage outside spindle from latch when in locked condition. Inside lever is always free for immediate egress.

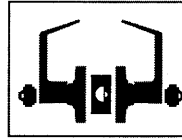
ND92PD F109



#### Entrance Lock †

Turn/push-button locking; pushing and turning button disengages outside lever, requiring use of key until button is manually unlocked. Push-button locking; pushing button disengages outside lever until unlocked by key or by turning inside lever. Vandlgard is designed to disengage outside spindle from latch when in locked condition. Inside lever is always free for immediate egress.

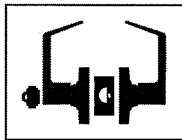
ND93PD F88



#### Vestibule Lock †

Latch retracted by key from outside when outside lever is disengaged by key in inside lever. Inside lever is always unlocked. Vandlgard is designed to disengage outside spindle from latch when in locked condition. Inside lever is always free for immediate egress.

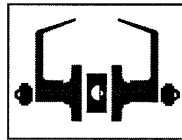
ND94PD F84



#### Classroom Lock †

Outside lever disengaged and unlocked by key. Inside lever always unlocked. Vandlgard is designed to disengage outside spindle from latch when in locked condition. Inside lever is always free for immediate egress.

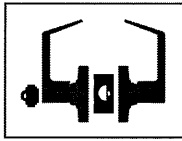
ND95PD



#### Classroom Security Lock †

Key in either lever locks or unlocks outside lever. Inside lever is always unlocked. Inside lever is always free for immediate egress.

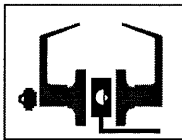
ND96PD F86



#### Storeroom Lock †

Outside lever always disengaged. Entrance by key only. Inside lever always unlocked. Vandlgard is designed to disengage outside spindle from latch when in locked condition. Inside lever is always free for immediate egress.

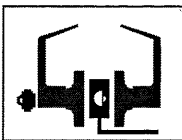
ND96PDEL



#### Electrically Locked (Fail Safe) †

Outside lever continuously disengaged electrically. Unlocked by key outside or by switch or power failure. Auxiliary latch deadlocks latchbolt when door is closed. Inside lever always free for immediate exit. Vandlgard is designed to disengage outside spindle from latch when in locked condition. Inside lever is always free for immediate egress.

ND96PDEU

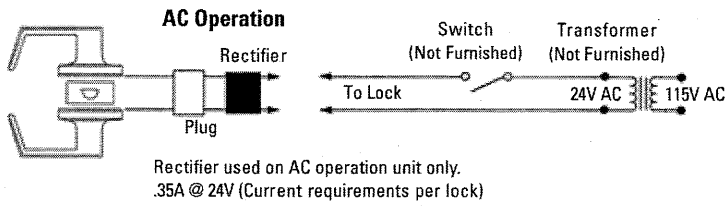


#### Electrically Unlocked (Fail Secure) †

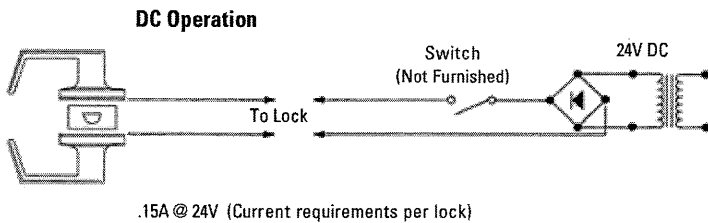
Outside lever continuously disengaged until unlocked by key or electric current. Auxiliary latch deadlocks latchbolt when door is closed. Inside lever always free for immediate exit. Vandlgard is designed to disengage outside spindle from latch when in locked condition. Inside lever is always free for immediate egress.

### Typical Wiring Diagram for Electrified Locks

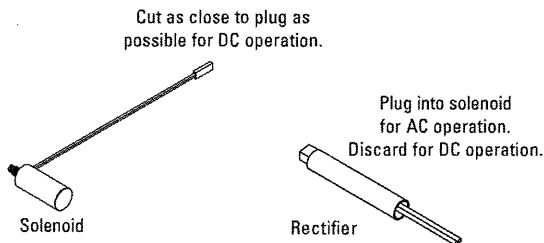
#### AC Power Source – EL or EU



#### DC Power Source – EL or EU



#### AC and DC Application



### Accessories

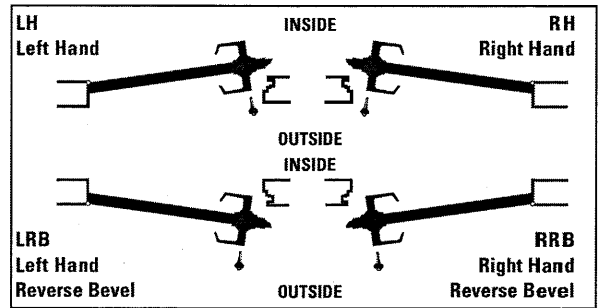
#### 1-3/8" D-Series Lever Door Spacer\*



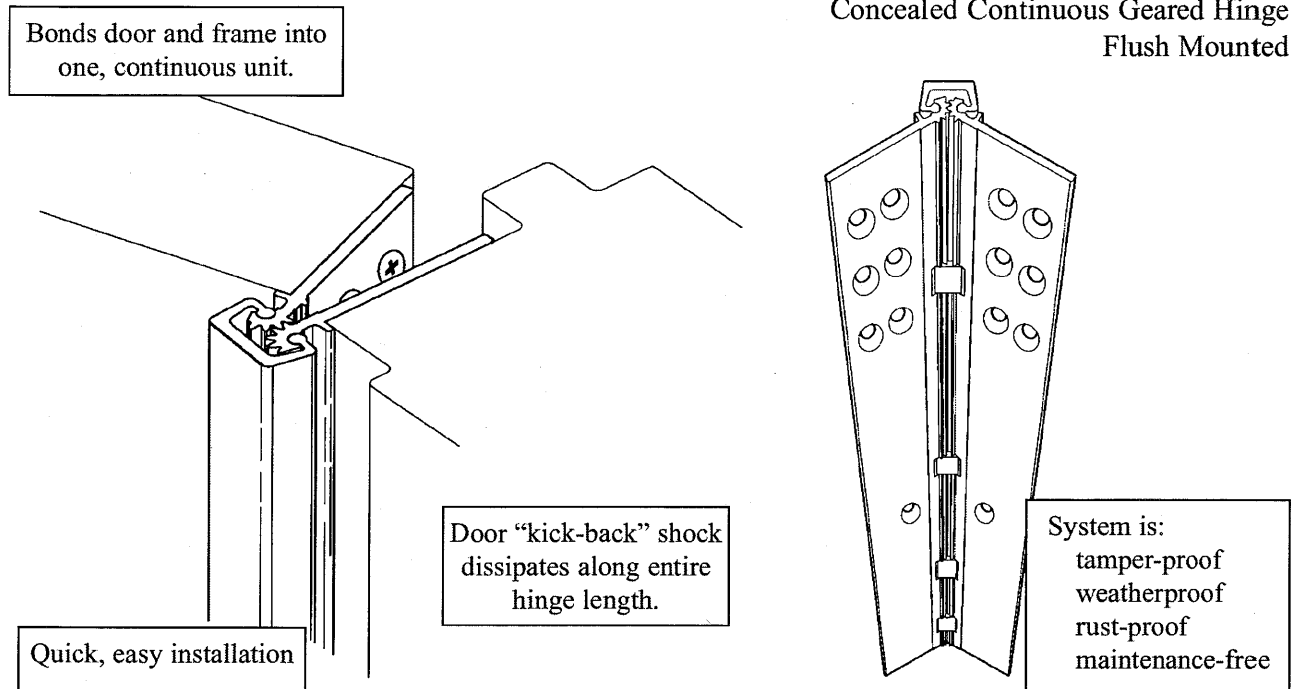
\*For installation on 1 3/4" doors, two (2) spacers are required. Specify finish.

### Door Handing

All Schlage® locks are reversible. Hand information is necessary to ensure proper finish of latchbolt and strike for split-finish locks. Follow the diagram to determine the hand of the door. The outside is the secure side or the corridor side.



**SELECT SL11, SL11HD and SL11LL**  
 Concealed Continuous Geared Hinge  
 Flush Mounted



Hinge failure is the most common cause of entrance failure. The **SELECT** Continuous Geared Hinge is a revolutionary development that puts an end to the costly and irritating problems associated with hinge failure.

With conventional hinges, door opening and “kick-back” energy is concentrated on a few inches of bolted or screwed-down reinforcing plate – the top hinge handles 100% of the force. The pin-less SL11, SL11HD and SL11LL bond the door and frame into an integrated, sag-free unit. “Kick-back” energy is dissipated along the length of the door and frame (compared to 4-1/2” to 5” at the top of the door and frame with conventional hinges).

**SELECT** Continuous Geared Hinges eliminate the gap between the door and the frame, providing a weatherproof, tamper-proof barrier. When the door is closed, there are no accessible screws, bolts or pins.

The SL11, SL11HD and SL11LL hinge hole patterns are templated; the same hole pattern within

the same length and from standard to heavy-duty. This feature of **SELECT** hinges makes multiple installations fast, easy and economical.

The vital components of **SELECT** hinges are anodized after machining, leaving a hardened aluminum oxide surface that resists wear.

The SL11, SL11HD and SL11LL are tested and listed by Underwriters Laboratories Inc. to standards UL10B, UL10C and UBC7.2 (positive pressure). Hinges are fire-rated for up to 1-1/2 hours or a special patented process can be added to increase the fire rating to 3 hours (NO PINS REQUIRED). Contact manufacturer for more information.

**APPLICATIONS:** The SL11, SL11HD and SL11LL are built to handle abuse from hard-traffic applications. The SL11, SL11HD and SL11LL mount flush with no door inset. **SELECT** hinges are surface applied to the frame and door—no machining or reinforcement is required.

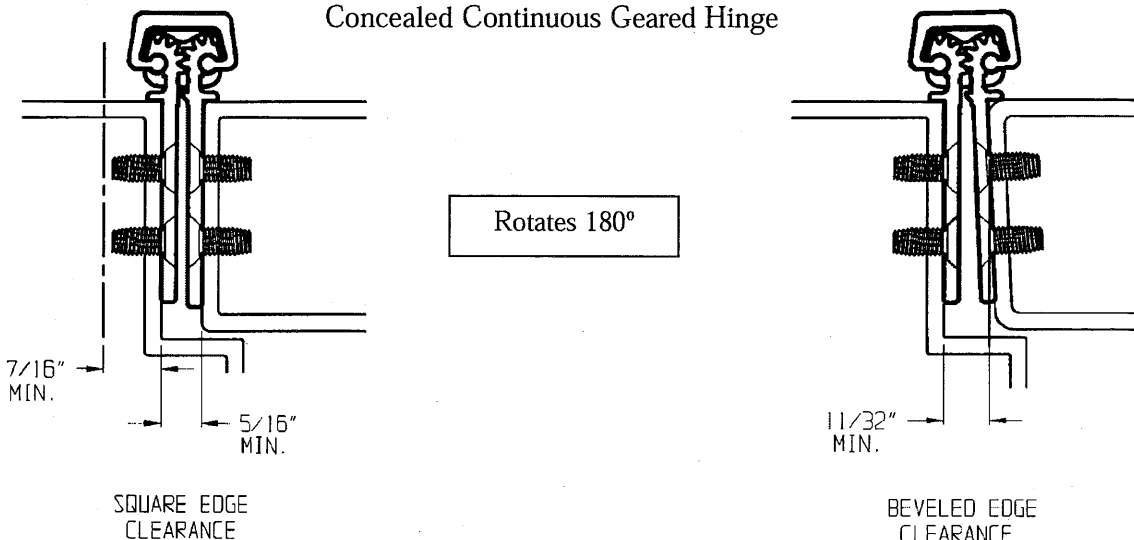


**SELECT PRODUCTS LIMITED**

9770 Shaver Road • Portage MI 49024 PH: (800)423-1174 • FX: (800)423-7107



**SELECT SL11, SL11HD and SL11LL**  
 Concealed Continuous Geared Hinge



**SPECIFICATIONS**

- MATERIAL:** Extruded 6063 T6 aluminum alloy with polyester thrust bearings.
- LENGTHS:** 83", 85", 95" and 120" lengths are standard for nominal door heights. The SL11, SL11HD and SL11LL can be ordered in special lengths or cut in the field.
- RATING:** SL11 for doors weighing up to 200 pounds. SL11HD for doors weighing up to 450 pounds—up to 600 pounds with the use of rivnuts in the frame and door. SL11LL for lead-lined doors and extra heavy-duty applications up to 1,000 pounds.
- FINISHES:** The SL11, SL11HD and SL11LL are stocked in 204R1 clear and .7 mil dark bronze anodized aluminum. Custom anodized or painted finishes are available. Product painted in the field voids the **SELECT** hinge warranty.
- NOTES:** Conventional overhead surface, concealed sliding overhead or floor closers may be used with **SELECT** hinges. Pivot-type floor closers (with a fixed, conflicting center pivot) must be replaced.
- The SL11, SL11HD and SL11LL are non-handed. Use same model for both right and left hand openings. After cutting, the hinge must be installed with the cut end on the bottom. The SL11, SL11HD and SL11LL mount flush with no door inset.
- For single door installations, allowing 1/8" lock side clearance, the net size of the door must be a minimum of 15/32" (square edge) or 1/2" (bevel edge) narrower than the rabbet to rabbet dimension of the frame. For double doors without mullions, allow 3/16" (for both square and bevel edge) between the leaves, plus 5/16" (square edge) or 11/32" (bevel edge) and 1/32" for each hinge, for a total of 7/8" (square edge) or 15/16" (bevel edge) between the net dimension of both doors and the rabbet to rabbet dimension of a double frame.
- ORDER:** Specify length, finish and standard-duty (SD), heavy-duty (HD) or lead-lined (LL). Also specify door and frame screw applications. 12-24 x 1/2" thread-forming, 410SS, flathead Phillips, undercut screws are provided as a standard pack unless otherwise specified. Wood, security and self-drilling, thread-forming screws also available.



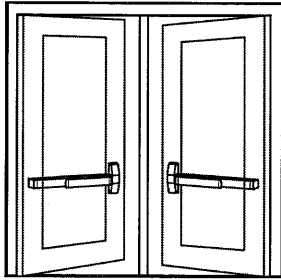
**SELECT PRODUCTS LIMITED**

9770 Shaver Road • Portage MI 49024 PH: (800)423-1174 • FX: (800)423-7107



# VON DUPRIN® Auxiliary Hardware and General Information

## REMOVABLE MULLIONS



Mullions provide single door performance in double door openings with rim devices. Mullions are easily removed by loosening bottom set screw and removing top fitting cover.

The top mullion fitting is attached to the frame and is concealed by the fitting cover.

Mullions are shipped presized, with mounting screws and prepared for strikes.

Strikes are not included except where indicated.

### To order, specify:

1. Model number.
2. Height of opening.
3. Finish.
4. Handing as required.
5. Center line deviation (refer to device template for standard centerline).
6. Strikes, when required, should be ordered with device.

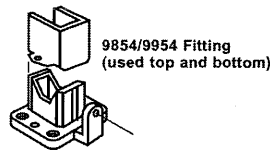
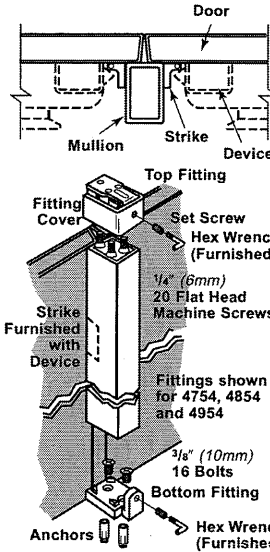
### Stock Hollow Metal Applications

Devices mounted to cover ANSI 161 cutouts are higher than the standard mullion strike location. Consult the factory for special strike preparation or order a blank mullion.

### Blank Mullions

Furnished without strike preparation and without fittings or stabilizers. Used to mount devices at a strike height different from the standard mullion preparation. Note: 9954 blank mullion is furnished less UL label.

## SIX STEEL MULLIONS



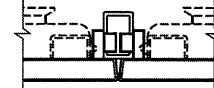
### Electric and Monitor Strikes

Includes an electric cable for transferring power from frame to strikes. The cable has five wires to a twist-apart plug that is connected to a mating socket through a hole in the top fitting.

For use with all Von Duprin panic exit rim devices.

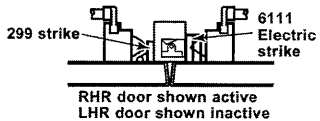
**4754** — Prepared for two 4263 monitor strikes.

4854/9854 — Using one electric strike



**4854** — Prepared for one 299 and one 6111 electric strike. Indicate handing for electric strike.

4854/9854 — Using one electric strike



### Standard Doors

**4954** — Prepared for two 264 or 299 strikes. For use with all Von Duprin panic rim devices. Note: specify strike choice with device.

**9854** — Prepared for one 499-F and one 6111 electric strike. Indicate handing for electric strike UL fire label mullion for 90 minute openings up to 8' x 8' (2438mm x 2438mm). This mullion is not easily removed due to special fittings.

### Fire Doors

**9954** — UL fire label mullion for up to 3 hour openings up to 8' x 8' (2438mm x 2438mm) using Von Duprin fire exit rim devices. Must be used with two 268 (for 88-F) or two 499F (for 22-F, 98-F, 99-F) strikes. This mullion is not easily removed due to special fittings.

**1654** — Prepared for two 1606 strikes.

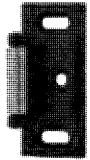
**Sizes** — 4754, 4854, 4954, 1654 — 7'2" (2184mm), 8'2" (2489mm), 10'2" (3099mm). 9854/9954 — 7'3" (2209mm), 8' (2438mm), 10'3" (3124mm) (no UL label on 10' (3048mm).

### Finishes

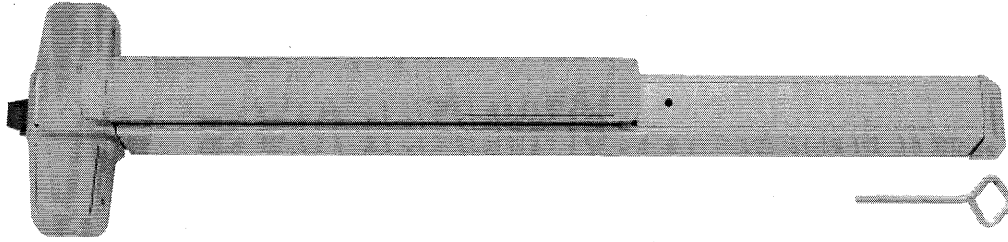
SP28 (sprayed aluminum), SP313 (sprayed dark bronze) or sprayed black.



# VON DUPRIN® 98/99™ Rim Exit Device



299 Strike



**98 and 99 rim exit devices** for all types of single and double doors with mullion, UL listed for Panic Exit Hardware. Devices are ANSI A156.3 – 2001 Grade 1. The 98 device has a smooth mechanism case and the 99 device has a grooved case. The rim device is non-handed except when the following device options are used: SD (Special Dogging), -2 (Double Cylinder) or SS (Signal Switch). See Opposite page for available outside trim and device functions. Covers stock hollow metal doors with 86 or 161 cutouts on single doors (may cover cutouts on pairs – consult template).




The 98/99 devices are available in the following finishes: US3, US4, US10, US26, US26D, US28, 313AN, 315AN and US32D for the 98 device only. See page 52 for component finishes and the inside cover for finish chips.

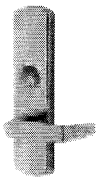
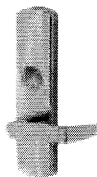
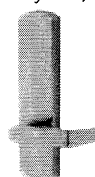
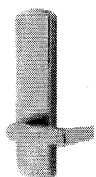
## Specifications

<b>Device Functions</b>	Device ships EO/DT/NL. Field selectable. For TP,K, or L remove NL drive screw from device	
<b>Device Lengths</b>	3' 2'4" to 3' (711mm to 914 mm) Door Size	
	4' 2'10" to 4' (864 mm to 1219 mm) Door Size	
<b>Strikes</b>	299 – Dull Black Optional Strikes – see page 39	
<b>Dogging Feature</b>	Hex key dogging standard	
<b>Dogging Options</b>	CD Cylinder Dogging	see page 48
	SD Special Center Case Dogging	see page 48
	LD Less Dogging	see page 48
<b>Electric Options</b>	LX Latchbolt Monitor Switch	see page 42
	RX Pushpad Monitor Switch	see page 42
	RX2 Double Pushpad Monitor Switch	see page 42
	E Electric Locking & Unlocking	see page 44
	EL Electric Latch Retraction	see page 43
	SS Signal Switch	see page 43
	CX Chexit Delayed Exit	see page 45
	ALK Alarm Exit Kit	see page 42
<b>Miscellaneous Options</b>	PN Pneumatic Latch Retraction	see page 48
	-2 Double Cylinder	see page 48
	GBK Glass Bead Kit	see page 49
<b>Fasteners &amp; Sex Bolts (SNB)</b>	Includes 1 3/4" (19mm) – 2 1/4" (57mm) Wood & Metal Doors Optional SNB available for device, see next page for quantities	
<b>Latch Bolt</b>	Deadlocking, 3/4" (19mm) throw	
<b>Device Centerline from Finished Floor</b>	39 13/16" (1011 mm) 39 11/16" (1008 mm) with Mullion	
<b>Center Case Dimensions</b>	8" x 2 3/4" x 2 3/8" (203mm x 70mm x 60mm)	
<b>Mechanism Case Dimensions</b>	2 1/4" x 2 1/4" (57mm x 57mm)	
<b>Projection</b>	Pushbar Neutral – 3 13/16" (97 mm) Pushbar Depressed – 3 1/16" (78 mm)	

See page 53 for How to Order specification

# VON DUPRIN® 98/99™ Rim Exit Device Standard Trim

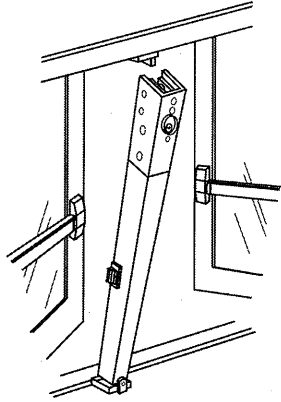
	Exit only	Dummy Trim Pull when Dogged	Night Latch Key Retracts Latchbolt	Night Latch Key Retracts Latchbolt Optional Pull Required
				
Product Description	98EO 99EO	98DT 99DT	98NL 99NL	98NL-OP 99NL-OP
Trim Description	--	990DT	990NL-R/V	110NL-MD 110NL-WD
Escutcheon Plate Size	--	3" x 14 <sup>9</sup> / <sub>16</sub> " x <sup>9</sup> / <sub>32</sub> " (76x360x2mm)	3" x 14 <sup>9</sup> / <sub>16</sub> " x <sup>9</sup> / <sub>32</sub> " (76x360x2mm)	--
Pull Center to Center	--	5 <sup>1</sup> / <sub>2</sub> " (140mm)	5 <sup>1</sup> / <sub>2</sub> " (140mm)	--
Projection	--	2" (51mm)	2" (51mm)	--
ANSI Function	01	02	03	03
Cylinder Type	--	--	Rim	Rim
Optional Trim (See pages 32 – 34)	x990EO x992EO x994EO x996EO	x991K-DT x992L-DT x994L-DT x996L-DT x696DT x697DT	x991K-NL x992L-NL x994L-NL x996L-NL x696NL x697NL	
Optional #425 Sex Bolt Quantity for Device	6	2	2	6

	Lever Key Locks & Unlocks	Lever – Night Latch Key Retracts Latchbolt	Lever – Blank Escutcheon Always operable (No Cylinder)	Lever Dummy Trim Pull when Dogged
				
Product Description	98L 99L	98L-NL 99L-NL	98L-BE 99L-BE	98L-DT 99L-DT
Trim Description	996L-R/V	996L-NL-R/V	996L-BE-R/V	996L-DT-R/V
Escutcheon Plate Size	2 <sup>3</sup> / <sub>4</sub> " x 10 <sup>3</sup> / <sub>4</sub> " x <sup>27</sup> / <sub>32</sub> " (70x273x21mm)	2 <sup>3</sup> / <sub>4</sub> " x 10 <sup>3</sup> / <sub>4</sub> " x <sup>27</sup> / <sub>32</sub> " (70x273x21mm)	2 <sup>3</sup> / <sub>4</sub> " x 10 <sup>3</sup> / <sub>4</sub> " x <sup>27</sup> / <sub>32</sub> " (70x273x21mm)	2 <sup>3</sup> / <sub>4</sub> " x 10 <sup>3</sup> / <sub>4</sub> " x <sup>27</sup> / <sub>32</sub> " (70x273x21mm)
Pull Center to Center	--	--	--	--
Projection	2 <sup>7</sup> / <sub>8</sub> " (73mm)	2 <sup>7</sup> / <sub>8</sub> " (73mm)	2 <sup>7</sup> / <sub>8</sub> " (73mm)	2 <sup>7</sup> / <sub>8</sub> " (73mm)
ANSI Function	08	09	--	02
Cylinder Type	Rim	Rim	--	--
Optional Trim (See pages 32 – 34)	x992L x994L	x992L-NL x994L-NL	x992L-BE x994L-BE	x992L-DT x994L-DT
Optional #425 Sex Bolt Quantity for Device	2	2	2	2

For optional trims and functions see pages 32-34

# VON DUPRIN® Auxiliary Hardware and General Information

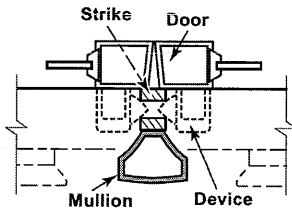
## KEYED REMOVABLE MULLION



**Keyed Removable Mullion** makes removal faster and easier by a single operation of the mortise cylinder. Mullions provide single door performance and security on double door applications. Once the mullion is removed, large equipment or furniture can freely pass through the opening. The unit will self lock when re-installed,

without use of the cylinder key.

## TWO ALUMINUM MULLIONS



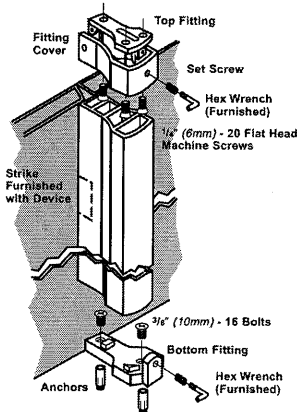
**5654** — Prepared for two 264 or 299 strikes with weatherstripping.

**5754** — Prepared and furnished with one 1408 double door strike.

*Note: Specify device "less strike".*

**Sizes** — 7'2" (2184mm), 8'2" (2489mm), 10'2" (3099mm).

**Finishes**  
US4 (brass anodized),  
US10 (bronze anodized),  
US28 (aluminum anodized) or 313AN (dark bronze anodized).



## 154 Stabilizer Set

A two-piece interlocking unit. One piece mounts on the mullion with the top mounting hole 5<sup>13</sup>/<sub>16</sub>" (148mm) below the centerline of the strike; the other piece mounts on the door. Shims are provided to adjust for misalignment between the door and mullion.

The set maintains integrity between the door and mullion to prevent vandalism and to ensure contact between the device and strike as the doors expand and contract with temperature changes.

This new lock assembly is available on Von Duprin's standard and fire labeled steel mullions, and can be purchased separately for retrofit on existing steel mullion applications. Sizes include 7'2" (2184mm), 8'2" (2489mm) and 10'2" (3099mm).

### To order, specify:

1. Model number KR165V4, KR4954, KR9854, K9954 or Retrofit Kit KR54, KR54-F.

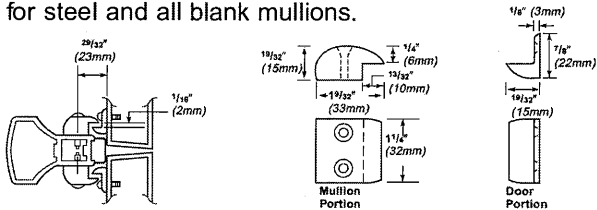
## MT54 Storage Mount

MT54 is a set of floor and wall brackets that provide convenient storage of the keyed removable mullion when removed from the opening.

### To order, specify:

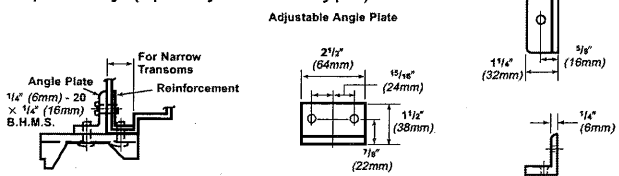
1. MT54

Furnished standard on aluminum mullions; optional for steel and all blank mullions.

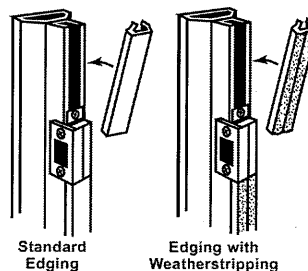


## Angle Plate

Used with narrow transom frames. The plate attaches to the transom to extend the surface area needed to mount the mullion. Must be ordered separately (specify mullion type).



## Weatherstripping



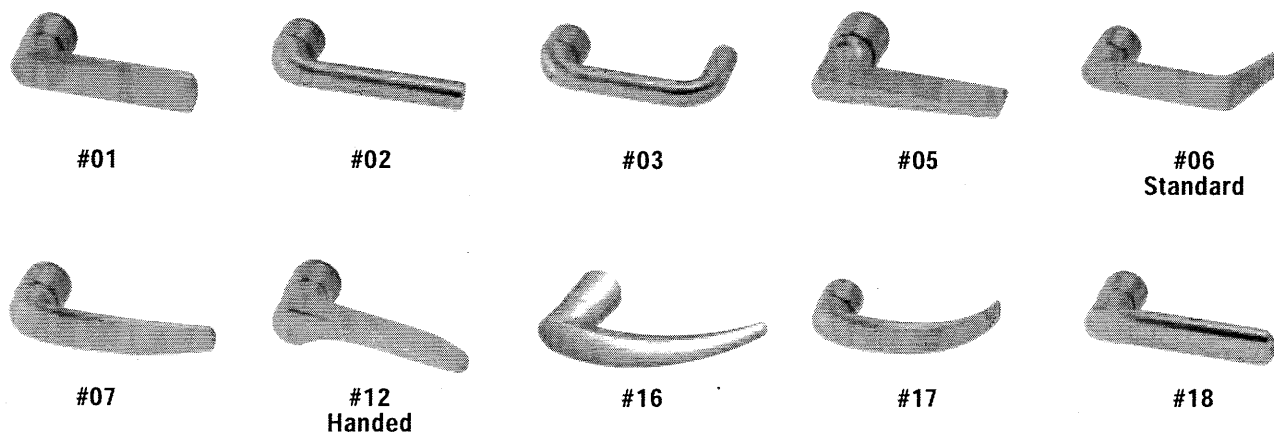
Weatherstripping retards cold air from blowing between doors and mullion. It also serves as a silencer when the door is closed against the mullion. The silicone treated weatherstrip pile is bonded to a polypropylene backing. A slide-in molding houses the weatherstripping, covers mounting screws of the strike and extends to both the top and bottom of the mullion.

# VON DUPRIN® 98/99™ Optional Trim

## Knob and Thumbpiece Trim

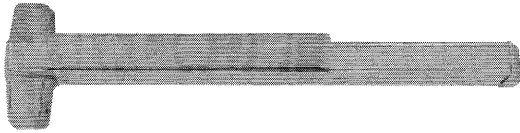
	Knob Key Locks & Unlocks	Knob – Night Latch Key Retracts Latchbolt	Knob – Blank Escutcheon Always Operable (No Cylinder)	Knob – Dummy Trim Pull when Dogged	Thumbpiece Key Locks & Unlocks	Thumbpiece Blank Escutcheon Always Operable (No Cylinder)
Trim Description	991K	991K-NL	991K-BE	991K-DT	990TP	990TP-BE
Escutcheon Plate Size	2¾" x 10¾" x 27/32" (70x273x21mm)	2¾" x 10¾" x 27/32" (70x273x21mm)	2¾" x 10¾" x 27/32" (70x273x21mm)	2¾" x 10¾" x 27/32" (70x273x21mm)	2¾" x 10¾" x 27/32" (70x273x21mm)	2¾" x 10¾" x 27/32" (70x273x21mm)
Pull Center to Center	---	---	---	---	5½" (140mm)	5½" (140mm)
Projection	3¼" (83mm)	3¼" (83mm)	3¼" (83mm)	3¼" (83mm)	2" (51mm)	2" (51mm)
ANSI Function	08	09	---	02	05	05
Cylinder Type						
Rim or Vertical Rod Device	Rim	Rim	---	---	Rim	---
Mortise Lock Device	1¼" Mortise	1¼" Mortise			1¼" Mortise	---
#425 SNB optional-HMD Req. WD w/o SLM Pkg.	2	2	2	2	2	2
#825 SNB Req. WD w/o SLM Pkg. F Rim device ONLY	2	2	2	2	2	2
#425 SNB Req. w/ 499F	2	2	2	2	2	2

## Lever Design Options



# VON DUPRIN® 98/99™ Options

## Pneumatic Controlled Exit Devices—PN



The PN feature provides remote latch bolt retraction in hazardous areas where electrically operated devices would not be permitted. The pneumatic solenoid will retract the latch bolt for momentary or prolonged periods. PN exit devices are particularly suited for use with automatic door operators. The PN feature is available on both Panic and Fire Exit Hardware devices.

The PN feature includes a special actuating linkage that gives building owners the option of mechanically or pneumatically dogging the exit device. If manual hex-key dogging is required, specify HD-PN (Dogging the device, whether mechanically or pneumatically, makes the device function as a push/pull unit and reduces the wear on its moving parts.) If cylinder dogging is required, the standard cylinder dogging is not available, but special center case dogging is available, specify SD-PN. SD-PN is not available on the 9875 or 9975 devices.

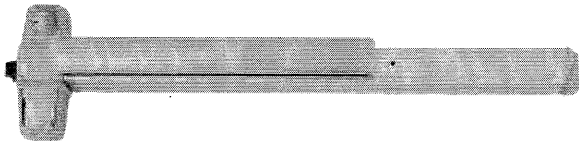
When activated pneumatically, the latch bolt(s) of the exit device retract in ½ to 1 ½ seconds. This pneumatic operation uses air pressure ranging from 50 to 100 pounds per square inch.

This product will function only when it is part of a pneumatic system (air compressor, air lines, pneumatic system, etc.). Contact LCN for correct control boxes

### To Order, Specify:

- Standard — Use prefix PN, example PN99NL
- Hex Key Dogging — Use prefix HD-PN, example HD-PN99NL
- Special Center Case Dogging — Use prefix SD-PN, example SD-PN99NL

## Double Cylinder – 2



Double cylinder features an inside key cylinder which locks or unlocks the outside trim and an outside key cylinder which retracts the latch bolt only (Night Latch Function). Available on rim or mortise lock device.

Rim requires two rim type cylinders. Mortise device requires 1 rim cylinder and 1 mortise cylinder with a straight cam. (Schlage cam reference B502-191.)

Available functions are thumbpiece, knob or lever.

### To Order, Specify:

1. Suffix-2 with device/trim number, example 99TP-2.
2. Handing required, LHR or RHR.

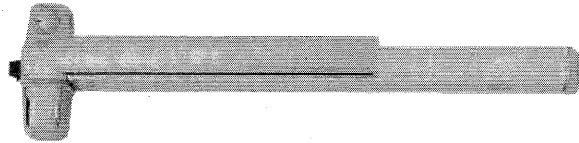
## Less Dogging – LD

Less Dogging is available in all 98/99™ Panic Exit devices to remove the dogging option.

### To Order, Specify:

- Use prefix LD, example LD99L

## Special Center Case Dogging – SD



Special cylinder dogging in the center case is available for Chexit, EL, ALK panic devices to allow for mechanical push/pull operation. With this option, the latchbolt is held retracted and pushbar is still operable. Specify handing — RHR or LHR.

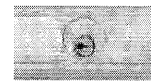
SD requires 1 ¼" (32mm) mortise cylinder with a straight cam. (Schlage cam reference B502-191.)

*Note: Available on Rim and Vertical Rod Panic Exit Devices only.*

### To Order, Specify:

- Use prefix SD, example SD99L

## Cylinder Dogging — CD



Cylinder dogging is available on all 98/99™ Panic Exit devices to replace the standard hex key dogging. Unit requires a standard 1 ¼" (32mm) mortise cylinder with a straight cam (Schlage Cam B502-191 reference).

### To Order, Specify:

- Use prefix, CD, example CD99L

## Cylinder Dogging Kit — CDK

For field conversion, a cylinder dogging conversion kit is available. Cannot be added to fire exit hardware.

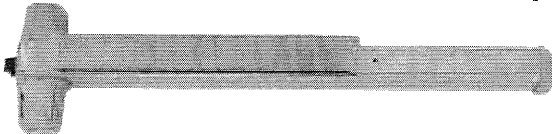
**Order: 33A/99CDK or 35A/98CDK, specify finish.**

## Hex Key Dogging Kit — HDK

For field conversion, a hex key dogging conversion kit is available. Cannot be added to fire exit hardware.

**Order: 33A/99HDK or 35A/98HDK, specify finish.**

## Braille, Embossed and Knurled Touchpads

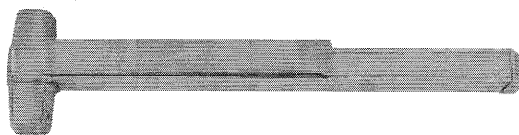


Braille touchpad is embossed with the message "CAUTION STAIRWELL" in braille and raised letters provides assistance to person with impaired vision. Letters are ½" (13mm) high and braille is #2, raised height is ⅜" (2mm). Other messages are available on special order, limited to 20 characters per line.

Embossed touchpad is embossed with the word "PUSH"  
Knurled touchpad is to provide warning to person with impaired vision.

# VON DUPRIN® 98/99™ Electrical Options

## Electric Latch Retraction — EL



The EL feature allows for the remote unlatching of exit devices. A control station operator can flip a switch to retract the latch bolt and immediately change an exit door to push-pull operation. A powerful, continuous duty solenoid retracts the latch bolt, either for momentary unlatching, or for extended periods of time. The EL feature is an alternative to manual dogging. If manual hex-key dogging is required, specify HD-EL. If cylinder dogging is required, the standard cylinder dogging is not available, but special center case dogging is available, specify SD-EL. SD-EL is not available on the 9875 or 9975 devices.

EL devices are also useful with automatic door operators, and may be applied to fire-rated applications when under the control of an **automatic fire alarm system**.

UL approved for Class II circuit applications.

The EL option does not include the power transfer from door to frame, the power supply, or the control operator. Refer to EPT-2 power transfer and the PS873 power supply.

The PS873 with the 871-2 option card is minimum option card required. Other option cards available for other functions, see PS873 power supply for additional information.

### Solenoid Specifications:

- Continuous Duty — 24 VDC
- Current Inrush — 16 Amps
- Current Holding — 0.3 Amps

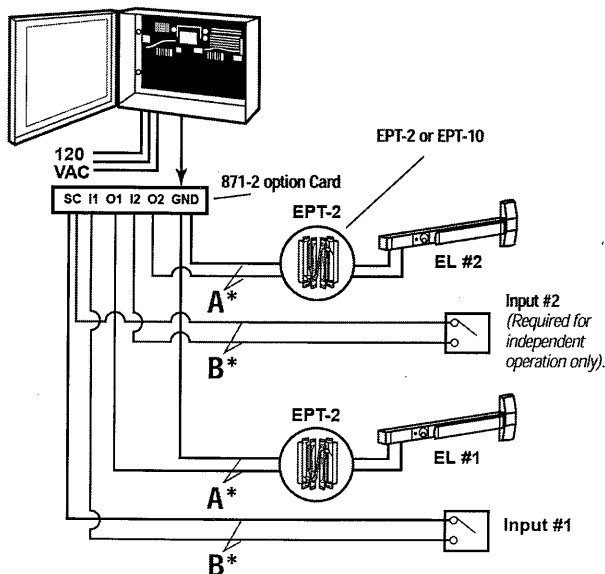
### To order, specify:

- Standard — Use prefix EL, example EL99L.
- Hex Key dogging — Use prefix HD-EL, example HD-EL99L.
- Special Center Case Dogging — Use prefix SD-EL, example SD-EL99L.

## Popular EL Application

### Power Supply PS873-2

Electric Power Transfer EPT-2 or EPT-10



## Signal Switch — SS



### Monitors pushpad and latch bolt

The SS feature is used to signal the unauthorized use of an opening. This device is equipped with two internal SPDT switches. One switch monitors both the pushpad and the latch bolt assembly, making the latch bolt tamper resistant, for positive security. An additional SPDT switch is connected to the 1 1/4" (32mm) mortise with straight cam for alarm "bypass." (Schlage cam reference B502-191). The device can be connected to a security console, or may be used as a single door alarm when used with a horn and power supply. A continuous current electric transfer must be used for transferring power from the frame to the door.

Pushpad reads:

"EMERGENCY EXIT ONLY – PUSH TO OPEN AND SOUND ALARM." Pushpad is only available in US32D finish with red silk-screened lettering.

The SS mortise lock device is furnished with both the signal switch device and the SS7500 mortise lock. The SS7500 mortise lock has the versatility and advantages of the 7500 lock with the addition of signalling functions to monitor latch bolt operation and the trim locking function. The SS7500 mortise lock is supplied standard with the SS mortise lock device.

### To Order, Specify:

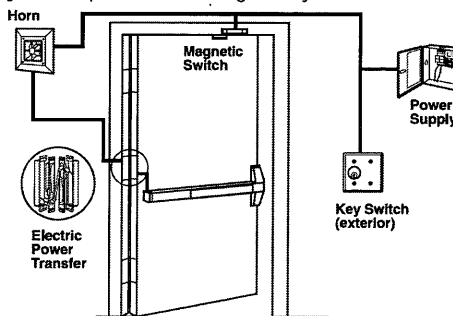
1. Prefix SS, example SS99L.
2. Handing Required, LHR or RHR.

### Electrical Ratings:

Up to 2.0 AMPS @ 24VDC

### Popular SS Application

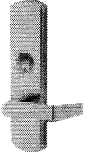
Unauthorized use of this opening will activate the local horn. The key switch permits inhibiting this system for authorized entry.



### EL Device Wire Selection Size

A*	Run Length	EL Device w/EPT or Door Loop
	0-100 ft.	14 gauge
	100-200 ft.	12 gauge
A*	Run Length	EL Device w/Electric Hinge/Pivot
	0-75 ft.	14 gauge
	75-150 ft.	12 gauge
B*	Wire Selection	Switch Wire Size
	1200 ft. Max.	18 gauge

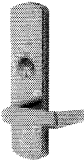
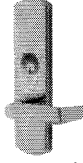

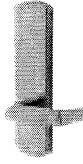
# VON DUPRIN® 98/99™ Optional Lever Trim

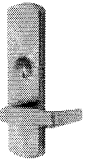


## 996L Trim

The new 996L Breakaway™ trim has become the standard lever trim offering on the 98L/99L series devices. The 996L trim blends two successful Von Duprin designs; the look of the traditional 992L lever trim and the security and durability of the Von Duprin Breakaway™ design. The Breakaway™ design is especially effective in areas where vandalism to door hardware is a problem. The design intent is to discourage costly repairs from becoming necessary. The Breakaway™ feature is not available on the NL (night-latch) or DT (dummy trim) versions.

## Optional Lever Trims – 992

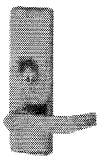
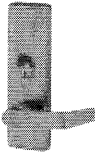
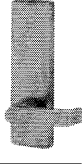

	<b>Lever</b> Key Locks and Unlocks 	<b>Lever – Night Latch</b> Key Retracts Latchbolt 	<b>Lever – Blank Escutcheon</b> Always Operable (No Cylinder) 	<b>Lever – Dummy Trim</b> Pull when Dogged (Not recommended for Fire Device) 
Trim Description	992L	992L-NL	992L-BE	992L-DT
Escutcheon Plate Size	2 9/4" x 10 9/4" x 27/32" (70x273x21mm)	2 9/4" x 10 9/4" x 27/32" (70x273x21mm)	2 9/4" x 10 9/4" x 27/32" (70x273x21mm)	2 9/4" x 10 9/4" x 27/32" (70x273x21mm)
Pull Center to Center	---	---	---	---
Projection	2 7/8" (73mm)	2 7/8" (73mm)	2 7/8" (73mm)	2 7/8" (73mm)
ANSI Function	08	09	---	02
Cylinder Type				
Rim or Vertical Rod Device	Rim	Rim	---	---
Mortise Lock Device	1 1/4" Mortise	1 1/4" Mortise	---	---



## 992L Trim

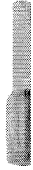



The 992L trim series provides the traditional Von Duprin escutcheon design. Special versions available for doors of over 2 1/4" (57mm) thicknesses. Additionally available in an RX and E-locking/unlocking version.

## Optional Lever Trims – 994





	<b>Lever</b> Key Locks and Unlocks 	<b>Lever – Night Latch</b> Key Retracts Latchbolt 	<b>Lever – Blank Escutcheon</b> Always Operable (No Cylinder) 	<b>Lever – Dummy Trim</b> Pull when Dogged (Not recommended for Fire Device) 
Trim Description	994L	994L-NL	994L-BE	994L-DT
Escutcheon Plate Size	2 9/4" x 9 1/4" x 27/32" (70x235x21mm)	2 9/4" x 9 1/4" x 27/32" (70x235x21mm)	2 9/4" x 9 1/4" x 27/32" (70x235x21mm)	2 9/4" x 9 1/4" x 27/32" (70x235x21mm)
Pull Center to Center	---	---	---	---
Projection	2 7/8" (73mm)	2 7/8" (73mm)	2 7/8" (73mm)	2 7/8" (73mm)
ANSI Function	08	09	---	02
Cylinder Type				
Rim or Vertical Rod Device	Rim	Rim	---	---
Mortise Lock Device	1 1/4" Mortise	1 1/4" Mortise	---	---

# VON DUPRIN® 98/99™ Exit Rim Device

## Optional Lever Trims – 696/697

	<b>Dummy Trim</b> Pull when Dogged (Not recommended for Fire Device) 	<b>Dummy Trim</b> Pull when Dogged (Not recommended for Fire Device) 	<b>Night Latch</b> Key Retracts Latchbolt 	<b>Night Latch</b> Key Retracts Latchbolt 
Trim Description	696DT	697DT	696NL	697NL
Escutcheon Plate Size	1 $\frac{5}{8}$ " x 13 $\frac{1}{2}$ " x $\frac{3}{16}$ " (41x343x5mm)	1 $\frac{5}{8}$ " x 13 $\frac{1}{2}$ " x $\frac{3}{16}$ " (41x343x5mm)	1 $\frac{5}{8}$ " x 13 $\frac{1}{2}$ " x $\frac{3}{16}$ " (41x343x5mm)	1 $\frac{5}{8}$ " x 13 $\frac{1}{2}$ " x $\frac{3}{16}$ " (41x343x5mm)
Pull Center to Center	5 $\frac{1}{2}$ " (140mm)	5 $\frac{1}{2}$ " (140mm)	5 $\frac{1}{2}$ " (140mm)	5 $\frac{1}{2}$ " (140mm)
Projection	2 $\frac{1}{8}$ " (52mm)	3" (76mm)	2 $\frac{1}{8}$ " (52mm)	3" (76mm)
ANSI Function	02	02	03	03
Cylinder Type				
Rim or Vertical Rod Device	--	--	Rim	Rim
Mortise Lock Device	--	--	1 $\frac{1}{4}$ " Mortise	1 $\frac{1}{4}$ " Mortise
#425 SNB optional-HMD Req. WD w/o SLM Pkg.	2	2	2	2
#825 SNB Req. WD w/o SLM Pkg.	2	2	2	2
#425 SNB Req. w/ 499F	2	2	2	2

## Optional Lever Trims – 696/697

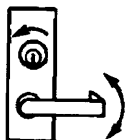
	<b>Thumbpiece</b> Key Locks & Unlocks 	<b>Thumbpiece</b> Key Locks & Unlocks 	<b>Thumbpiece - Blank Escutcheon</b> Always Operable (No Cylinder) 	<b>Thumbpiece - Blank Escutcheon</b> Always Operable (No Cylinder) 
Trim Description	696TP	697TP	696TP-BE	697TP-BE
Escutcheon Plate Size	1 $\frac{5}{8}$ " x 13 $\frac{1}{2}$ " x $\frac{3}{16}$ " (41x343x5mm)	1 $\frac{5}{8}$ " x 13 $\frac{1}{2}$ " x $\frac{3}{16}$ " (41x343x5mm)	1 $\frac{5}{8}$ " x 13 $\frac{1}{2}$ " x $\frac{3}{16}$ " (41x343x5mm)	1 $\frac{5}{8}$ " x 13 $\frac{1}{2}$ " x $\frac{3}{16}$ " (41x343x5mm)
Pull Center to Center	5 $\frac{1}{2}$ " (140mm)	5 $\frac{1}{2}$ " (140mm)	5 $\frac{1}{2}$ " (140mm)	5 $\frac{1}{2}$ " (140mm)
Projection	2 $\frac{1}{8}$ " (52mm)	3" (76mm)	2 $\frac{1}{8}$ " (52mm)	3" (76mm)
ANSI Function	05	05	05	05
Cylinder Type				
Rim or Vertical Rod Device	Rim	Rim	--	--
Mortise Lock Device	1 $\frac{1}{4}$ " Mortise	1 $\frac{1}{4}$ " Mortise	--	--
#425 SNB optional-HMD Req. WD w/o SLM Pkg.	2	2	2	2
#825 SNB Req. WD w/o SLM Pkg.	2	2	2	2
#425 SNB Req. w/ 499F	2	2	2	2



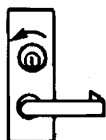
# VON DUPRIN. 98/99™ Trim Operation Selection

## Operation Options

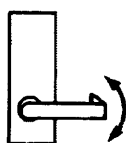
### Lever and Knob Operations



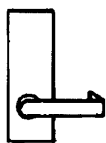
Standard operation, key locks and unlocks lever or knob. e.g., 996L (Classroom)



Night latch, key retracts latch bolt. Lever or knob is rigid. Use NL suffix, e.g. 996LNL. (Storeroom)

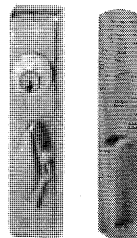


Blank escutcheon, lever or knob always active. Use BE suffix, e.g., 996L-BE. (Passage)



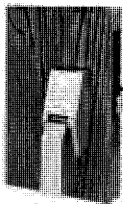
Dummy trim, lever or knob rigid for pull operation. Use DT suffix, e.g., 996L-DT.

### 374T/376T Series Thumbturn Control (Shown with 990DT Trim)



Standard operation, key locks and unlocks thumbturn. Optional operation, key unlocks thumbturn, re-locks when key is removed. This operation is created by changing the cylinder plate included with control. Use 1 1/4" mortise cylinder with a straight cam. Schlage cam reference B502-191.

### HL6 Exit Device Trim Option



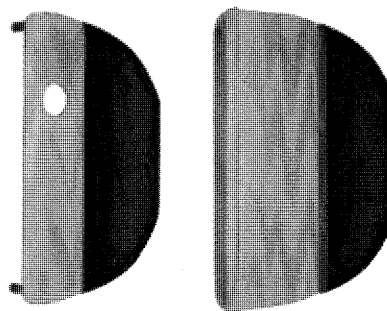
Von Duprin and Glynn-Johnson have collaborated on an exit device trim that answers the problem of accessibility and performance. Using the Von Duprin 98/9975 mortise lock exit device along with the Glynn-Johnson HL6 Push/Pull latch, Ingersoll-Rand has created an exit device with mortise lock durability that utilizes a fully ADA compliant Pull paddle trim. The 98/9975HL device is available in all standard architectural finishes and can be found in the Von Duprin device price list for easy ordering.

### Vandal Resistant Trim

#### VR910 & VR914 Series

##### Features:

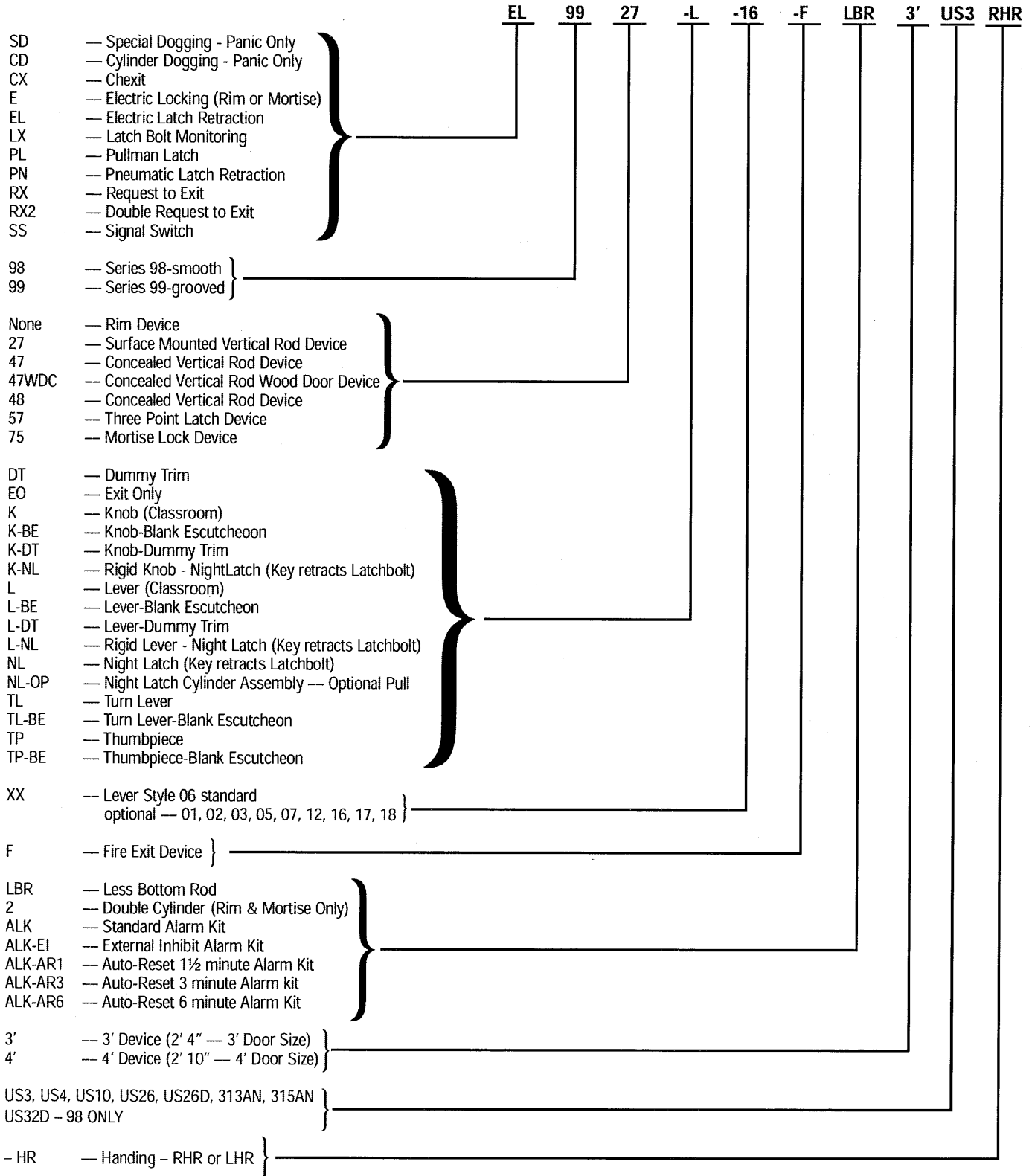
- Stainless Steel construction, 11 gage (0.120" thick)
- Thru-bolts and rugged mounting screws for maximum fastening strength.
- 10-24 screws supplied with VR910 & VR914 models.
- Built-in lock protector prevents vandalism to mortise latchbolt (available on certain models).
- Extra-tough stainless steel cylinder collar prevents pipe wrench or similar tool from damaging cylinder. Tapered design prevents side impacts from transferring directly to cylinder. Collar spins freely.
- Furnished with mounting screws for door thicknesses of 1 1/4" to 2 1/4"
- Finish: US32D
- VR910 grip coated in black plastisol for softer touch and resilience to temperature extremes. Grip designed for comfortable operation.
- VR914 grip in all stainless steel.
- Meets ANSI/BHMA 156.13, Trim Security Test and California State Accessibility Standards Title 24.
- 1 1/2" (38mm) clearance from grip to door
- 1 7/8" (48mm) total projection from door
- Consult IVES catalog for specification/ordering information.



Model	For Use With	Size
VR910DT & VR914DT	98/99 Rim or Vert. Rod Device	5 1/4" (133mm) w x 11" (279mm) h
VR910NL & VR914NL	98/99 Rim or Vert. Rod Device	5 1/4" (133mm) w x 11" (279mm) h
VR910M-DT & VR914M-DT	9875/9975 Mortise Device	7 1/4" (184mm) w x 11" (279mm) h
VR910M-NL & VR914M-NL	9875/9975 Mortise Device	7 1/4" (184mm) w x 11" (279mm) h

# VON DUPRIN® 98/99™ Additional Information

## Nomenclature – How To Order



# VON DUPRIN. E996L Electrified Breakaway™ Lever Trim

**E996L** electrified Breakaway lever trim provides remote locking and unlocking capabilities while incorporating the patented Breakaway trim design.

The 24VDC solenoid can be energized from a distant controller, thus allowing access control of the opening. The control of stairwells in high-rise buildings is a common application for this trim.

When electrically unlocked the unit operates as a normal lever trim. When electrically locked, the lever feels locked, but when more than 35 pounds of torque pressure is applied, the Breakaway lever feature engages.

The E996L is provided standard in a fail safe (FS) condition, but can be field converted to a fail secure (FSE) where allowed. The trim can be ordered with a device, added to an existing 98/99 series device application, or a conversion kit can be added to an existing 996L Breakaway lever trim. On new construction applications, the E996L trim will require less door prep.

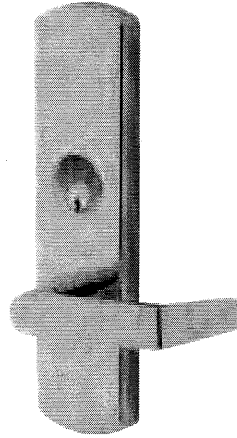
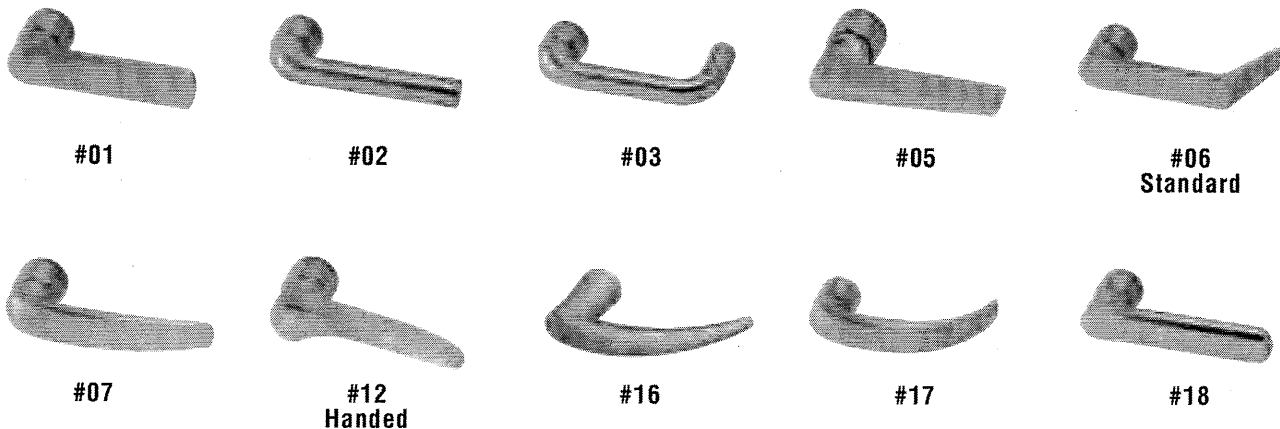
The E996L is available with a blank escutcheon (BE) function, or with a cylinder for night latch function.

The E996L electrified trim replaces the current "E" electric feature on 98/99 series rim devices. Consult factory for requirements.

**To Order, Specify:**

1. Use "E" prefix, example E996L.  
When ordering with device specify trim series with "E" prefix, example 9927L-BE 3' US26D E996.
2. Device type, R/V (rim/surface or concealed vertical rod) or M (mortise).
3. RHR is furnished standard if not specified.  
Field reversible.
4. Lever style (06 lever is furnished standard).
5. Finish: US3, US4, US10, US10B, SP313, US26, US26D, SPBLK, US15

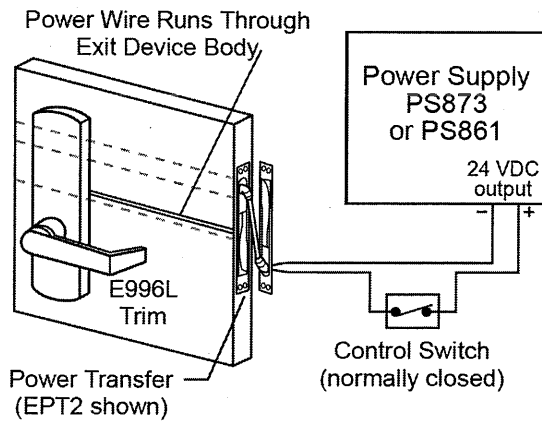
**LEVER DESIGN OPTIONS**



SPECIFICATIONS
Solenoid – Continuous Duty 24VDC
Solenoid Draw – 0.22 amp

**E996L ELECTRICAL WIRING**

- Power input for E996L is 24VDC
- Two wires on trim are non-polarized (18 AWG minimum)



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**SECTION 08 90 00**

**LOUVERS AND VENTS**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section Includes: Louvers and vents.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- C. Related Sections
  - 1. Section 07 92 00 - Joint Sealants: Provision of sealers and caulks.
  - 2. Section 09 90 00 - Painting and Coating: For finish painting.

**1.02 REFERENCES**

- A. AMCA - Air Movement and Control Association
  - 1. 500 - Test Methods for Louvers, Dampers.
  - 2. 501 - Application Manual for Air Louvers.
  - 3. 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
- B. ASTM - American Society for Testing and Materials
  - 1. B221 - Standard Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes.
- C. AWS - American Welding Society
  - 1. D1.3 - Structural Welding Code--Sheet Steel.
- D. NAAMM - National Association of Architectural Metal Manufacturers
  - 1. MFM - Metal Finishes Manual.
- E. SMACNA - Sheet Metal and Air Conditioning Contractors National Association, Inc.
  - 1. Architectural Sheet Metal Manual.
- F. SSPC - The Society for Protective Coatings
  - 1. Paint 12 - Paint Specification No. 12: Cold-Applied Asphalt Mastic (Extra Thick Film).

**1.03 DEFINITIONS**

- A. Louver Terminology: Refer to AMCA 501 for definitions of terms for metal louvers not otherwise defined in this Section or in referenced standards.

**1.04 SYSTEM DESCRIPTION**

- A. Performance Requirements
  - 1. Structural Performance: Fabricate and install exterior metal wall louvers to withstand the effects of loads and stresses from wind and normal thermal movement without evidencing permanent deformation of louver components including blades, frames, and supports; noise or metal fatigue caused by louver blade rattle or flutter; or permanent damage to fasteners and anchors.

2. Normal thermal movement is defined as that resulting from the following maximum change (range) in ambient temperature. Base design calculations on actual surface temperatures of metals due to both solar heat gain and nighttime sky heat loss.
  - a. Temperature Change (Range): 100 degrees Fahrenheit.
3. Air-Performance, Water-Penetration, and Air-Leakage Ratings: Provide louvers complying with performance requirements indicated as demonstrated by testing manufacturer's stock units of height and width indicated. Test units according to AMCA 500.
  - a. Perform testing on unpainted, cleaned, degreased units.
  - b. Perform water-penetration testing on louvers without screens.
  - c. Equivalent Air-Performance Ratings: Louvers having less free area than that specified or having a lower free area velocity at the static pressure loss specified may be considered for the Work provided their total air performance is equivalent to that specified. The burden of proof of equivalency is on the Contractor. For louvers to be considered equivalent, the product of their free area, for the size specified, and their free area velocity at the static pressure loss specified must be at least equal to the product of the specified free area and velocity. Also, their free area velocity at the static pressure loss specified must not result in water penetration of more than 0.01 ounce per square foot of free area, and they must meet all other requirements.

#### **1.05 SUBMITTALS**

- A. Product Data: Submit manufacturer's product data for each type of product specified.
- B. Quality Control Submittals
  1. Test Reports: Submit product test reports evidencing compliance of units with performance requirements indicated.
  2. Certificates: Submit product certificates signed by louver manufacturers certifying that their products comply with the specified requirements and are licensed to bear the AMCA seal based on tests made according to AMCA 500 and complying with the AMCA Certified Ratings Program.

#### **1.06 QUALITY ASSURANCE**

- A. Welding Standards: Comply with applicable provisions of AWS D1.3.
  1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
- B. SMACNA Standard: Comply with SMACNA "Architectural Sheet Metal Manual" recommendations for fabrication, construction details and installation procedures.

#### **1.07 PROJECT CONDITIONS**

- A. Field Measurements: Check actual louver openings by accurate field measurements before fabrication, and show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
  1. Where field measurements cannot be made without delaying the Work, guarantee opening dimensions and proceed with fabricating louvers without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to guaranteed dimensions.

### **PART 2 - PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Acceptable Manufacturers: The Airolite Co. LLC, "Drainable Louver, Louver Type K6774"; Construction Specialties, Inc., or equal.

## **2.02 MATERIALS**

- A. Aluminum Extrusions: ASTM B221, Alloy 6063-T5.
- B. Fasteners: Of same basic metal and alloy as fastened metal or 300 series stainless steel, unless otherwise indicated. Do not use metals that are corrosive or incompatible with joined materials.
  - 1. Use types and sizes to suit unit installation conditions.
  - 2. Use Phillips flat-head screws for exposed fasteners, unless otherwise indicated.
- C. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC Paint 12 except containing no asbestos fibers.
- D. Flexible Flashing: Grace Construction Products, "Vycor V40", or equal.

## **2.03 FABRICATION**

- A. General: Fabricate louvers to comply with requirements indicated for design, dimensions, materials, joinery, and performance.
- B. Assemble louvers in shop to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- C. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.
- D. Maintain equal louver blade spacing to produce uniform appearance.
- E. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances of louvers, adjoining construction and perimeter sealant joints.
- F. Include supports, anchorages and accessories required for complete assembly.
- G. Provide concealed vertical mullions of type and at spacings indicated but not more than recommended by manufacturer, or 72 inches on center, whichever is less. Mullions shall be attached to the blades from the interior side.
- H. Provide sill extensions and loose sills made of same material as louvers where indicated or required for drainage to exterior and to prevent water penetrating to interior.
- I. Join frame members to one another and to fixed louver blades as follows, unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary:
  - 1. With fillet welds, concealed from view.
  - 2. With fillet welds, concealed from view; or mechanical fasteners; or a combination of these methods; as standard with louver manufacturer.

## **2.04 FIXED WALL LOUVERS**

- A. Horizontal, Drainable, Fixed-Blade Louvers: Frames and louver blades, designed to collect and drain water to exterior at sill by means of gutters in front edges of blades and channels in jambs and mullions, complying with the following requirements:
  - 1. Louver Depth: 4 inches.
  - 2. Louver Size: As indicated on the Drawings.
  - 3. Frame Thickness: 0.081-inch, unless otherwise indicated.
  - 4. Blade Thickness: 0.081-inch, unless otherwise indicated.

5. Blade Angle: 45 degrees, unless otherwise indicated.
6. Provide rainwater scoop at interior side.

## **2.05 SCREENS**

- A. General: Provide each exterior louver with screens complying with the following requirements:
  1. Screen Location for Fixed Louvers: Interior face, unless otherwise indicated.
  2. Insect Screening Type: 1/4-inch grid wire fabric with extruded aluminum frame where indicated.
- B. Secure screens to louver frames with stainless-steel machine screws, spaced 6 inches maximum from each corner and at 12 inches on center between.

## **2.06 FINISHES, GENERAL**

- A. General
  1. Comply with NAAMM MFM for recommendations relative to applying and designating finishes.
  2. Finish louvers after assembly.
- B. Aluminum: Manufacturer's standard 3-coat fluoropolymer finish conforming to AAMA 2605.
  1. Color: As selected by the Architect from manufacturer's standard range.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. Locate and place louver units plumb, level, and at indicated alignment with adjacent work. Install weathered lapped into building paper coursing at wall installations with flexible flashing comparable to window installations as detailed in Construction Documents..
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Repair finishes damaged by cutting, welding, soldering and grinding operations required for fitting and jointing. Restore finishes so there is no evidence of corrective work. Return items that cannot be refinished in the field to the shop, make required alterations and refinish entire unit, or provide new units.
- F. Protect nonferrous metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry or dissimilar metals.
- G. Install concealed gaskets, flashings, joint fillers and insulation, as louver installation progresses, where required to make louver joints weathertight. Comply with Section 07 92 00 for sealants applied during installation of louver.

### **3.02 ADJUSTING AND PROTECTION**

- A. Protect louvers from damage of any kind during construction period including use of temporary protective coverings where needed and approved by louver manufacturer. Remove protective covering at time of Substantial Completion.



- B. Restore louvers damaged during installation and construction period, so that no evidence remains of correction work. If results of restoration are unsuccessful, as judged by the Architect, remove damaged units and replace with new units.
  - 1. Clean and touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

**3.03 CLEANING**

- A. Periodically clean exposed surfaces of louvers that are not protected by temporary covering to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.
- B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Rinse surfaces thoroughly and dry.

**END OF SECTION**

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**SECTION 09 90 00**

**PAINTING AND COATING**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section Includes: Surface preparation, painting and finishing of exposed new and existing exterior and interior items and surfaces.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- C. Related Sections
  - 1. Section 05 50 00 - Metal Fabrications: Shop priming ferrous metal.
  - 2. Section 06 10 00 - Rough Carpentry: Provision of rough carpentry.
  - 3. Section 07 19 00 - Water Repellents: Provision of water repellent coating.
  - 4. Section 07 92 00 - Joint Sealants: Provision of joint sealers and caulks.
  - 5. Section 08 11 15 - Steel Doors and Frames: Provision of steel doors and frames.
  - 6. Section 08 90 00 - Louvers and Vents: Provision of louvers and vents.

**1.02 REFERENCES**

- A. FM - Factory Mutual
- B. UL - Underwriters Laboratories Inc.

**1.03 SYSTEM DESCRIPTION**

- A. Performance Requirements
  - 1. Paint exposed surfaces whether or not colors are designated in the schedules, except where a surface or material is specifically indicated not to be painted or is to remain natural.
  - 2. Painting is not required on prefinished items, finished metal surfaces, concealed surfaces, operating parts and labels.
  - 3. Do not paint over UL, FM, or other code required labels or equipment name, identification, performance rating or nomenclature plates.

**1.04 SUBMITTALS**

- A. Product Data: Submit manufacturer's product data for each paint system specified, including primers.
- B. Samples
  - 1. Following the selection of colors and glosses by the Architect, submit samples for the Architect's review.
    - a. Provide 3 samples of each color and each gloss for each material on which the finish is specified to be applied.
    - b. Make samples approximately 8 inches by 10 inches in size.
    - c. If so directed by the Architect, provide field mock-ups during progress of the Work in the form of actual application of the materials on actual surfaces to be painted for approval by the Architect. Areas shall be 10 feet by 10 feet.
  - 2. Do not commence finish painting until samples are approved.

## **1.05 QUALITY ASSURANCE**

- A. Provide primers and undercoat paint produced by the same manufacturer as finish coats.
  - 1. Review other Sections of these Specifications as required, verifying the prime coats to be used and assuring compatibility of the total coating system for the various substrates.
  - 2. Provide barrier coats over non-compatible primers, or remove the primer and re-prime as required.
  - 3. Notify the Architect in writing of anticipated problems in using the specified coating systems over prime coatings supplied under other Sections.

## **1.06 MAINTENANCE**

- A. Upon completion of the work of this Section, deliver to the District an extra stock equaling 1 gallon of each color, type and gloss of paint used in the Work; tightly sealing each container, and clearly labeling with contents and location where used.

## **PART 2 - PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Acceptable Manufacturer: Kelly Moore (District standard).

### **2.02 PAINT MATERIALS**

- A. Pursuant to Section 3400 of the Public Contract Code the following materials, products, equipment, or systems are now in use on the particular public improvement described as San Mateo County Community College District. At each instance in these specifications that said designated materials, products, equipment or systems are designated by the brand name(s), listed below, they are so designated to match the existing finishes or maintain compatibility and continuity in functionality, controls and / or replacement parts that are in place at Cañada College. The Contractor will furnish and apply only these brands of designated materials, products, equipment or systems, and no substitutions shall be deemed to be "or equal" or allowed.
- B. Material Quality: Provide manufacturer's best quality trade sale paint material of the various coating types specified.
- C. Colors: Match existing Campus Standard colors.
  - 1. Exterior Work
    - a. Building 30: Match Kelly Moore - 09-1005-1102 - Hickory Wind.
    - b. Building 3 and 16: Match existing colors.
      - 1) Kelly Moore - 05-1198-1112 - Wall Color.
      - 2) Kelly Moore - 09-1005-1102 - Hickory Wind.
      - 3) Kelly Moore - KM #149 - Green Thumb.
  - 2. Interior Work
    - a. Field Color: Match Kelly Moore (District Standard) - 27 Bone.
    - b. Accent Colors: None.

## **PART 3 - EXECUTION**

### **3.01 PREPARATION**

- A. General: Mix and prepare paint materials in strict accordance with the manufacturers' recommendations as approved by the Architect.

- B. Surface Preparation
  - 1. General
    - a. Perform preparation and cleaning procedures in strict accordance with the paint manufacturers' recommendations as approved by the Architect.
    - b. Remove removable items which are in place and are not scheduled to receive paint finish; or provide surface applied protection prior to surface preparation and painting operations.
    - c. Following completion of painting in each space or area, reinstall the removed items by using workmen who are skilled in the necessary trades.
  - 2. Schedule the cleaning and painting so that dust and other contaminants from the cleaning process will not fall onto wet newly painted surfaces.
- C. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- D. Plaster Substrates: Do not begin paint application until plaster is fully cured and dry.
  - 1. Crack Filler: Minor cracks less than 1/32-inch in width do not require filling. Repair cracks in surface up to 1/16-inch by 1/16-inch with crack filler in accordance with manufacturer's recommendations.
- E. Preparation of Wood Surfaces
  - 1. Clean wood surfaces until free from dirt, oil, and other foreign substance.
  - 2. Smooth finished wood surfaces exposed to view, using the proper sandpaper. Where so required, use varying degrees of coarseness in sandpaper to produce a uniformly smooth and unmarred wood surface.
  - 3. Unless specifically approved by the Architect, do not proceed with painting of wood surfaces until the moisture content of the wood is 12 percent or less as measured by a moisture meter approved by the Architect.
  - 4. Back prime concealed wood surfaces.
- F. Preparation of Metal Surfaces
  - 1. Thoroughly clean surfaces until free from dirt, oil and grease.
  - 2. On galvanized surfaces, use solvent for the initial cleaning, and then treat the surface thoroughly with the phosphoric acid etch. Remove etching solution completely before proceeding.
  - 3. Allow to dry thoroughly before application of paint.

### **3.02 PAINT APPLICATION**

- A. General
  - 1. Touch-up shop-applied prime coats which have been damaged, and touch-up bare areas prior to start of finish coats application.
  - 2. Slightly vary the color of succeeding coats.
  - 3. Sand and dust between coats to remove defects visible to the unaided eye from a distance of 5 feet.
  - 4. On removable panels and hinged panels, paint the back sides to match the exposed sides.
- B. Drying: Allow sufficient drying time between coats, modifying the period as recommended by the material manufacturer to suite adverse weather conditions.
- C. Brush Applications
  - 1. Brush out and work the brush coats onto the surface in an even film.
  - 2. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness and other surface imperfections will not be acceptable.

- D. Spray Application
  - 1. Confine spray application to metal framework and similar surfaces where hand brush work would be inferior.
  - 2. Where spray application is used, apply each coat to provide the hiding equivalent of brush coats.
  - 3. Do not double back with spray equipment to build up film thickness of 2 coats in 1 pass.
  
- E. Miscellaneous Surfaces and Procedures
  - 1. Exposed Mechanical Items
    - a. Finish electric panels, access doors, conduits, pipes, ducts, grilles, registers, vents and items of similar nature to match the adjacent wall and ceiling surfaces, or as directed.
    - b. Paint visible duct surfaces behind vents, registers, and grilles flat black.
    - c. Wash metal with solvent, prime and apply 2 coats of alkyd enamel.
    - d. All roof mounted mechanical units shall be painted.
  - 2. Exposed Pipe and Duct Insulation
    - a. Apply 1 coat of latex paint on insulation which has been sized or primed under other Sections; apply 2 coats on such surfaces when unprepared.
    - b. Match color of adjacent surfaces.
    - c. Remove band before painting, and replace after painting.
  - 3. Hardware
    - a. Paint prime coated hardware to match adjacent surfaces;
    - b. Paint metal portions of head seals, jamb seals, and astragal seals to match the color of the door frame unless otherwise directed by the Architect.
  - 4. Wet Areas
    - a. For oil base paints, use 1 percent phencimercuric or 4 percent tetrachlorophenol.
    - b. For water emulsion and glue size surfaces, use 4 percent sodium tetrachlorophenate.
  - 5. Interior: Use "stipple" finish where enamel is specified.
  - 6. Exposed Vents: Apply 2 coats of heat resistant paint approved by the Architect.

### **3.03 EXTERIOR PAINT SCHEDULE**

- A. Concrete and Masonry
  - 1. 100 Percent Acrylic Elastomeric Coating: 2 finish coats over a primer (if required).
    - a. Primer Where Required
      - 1) 100 percent acrylic primer applied at spreading rate recommended by the manufacturer.
      - 2) Product: Kelly Moore - 247 Acry-Shield.
    - b. First and Second Finish Coats
      - 1) Acrylic coating applied at spreading rate recommended by the manufacturer.
      - 2) Product: Kelly Moore - 1128 Kel-Seal Terpolymer.
  - 2. 100 Percent Acrylic Semi-Gloss Enamel: Apply over elastomeric paint on lower walls in circulation areas to provide cleanable wear layer.
    - a. Product: Kelly Moore - 1685 Dura-Poxy+.
  
- B. Metal and Wood Surfaces Adjacent to Building Wall and Colonnade Ceilings
  - 1. 100 Percent Acrylic Semi-Gloss Enamel: 2 finish coats over a primer.
    - a. Primer
      - 1) 100 percent acrylic primer applied at spreading rate recommended by the manufacturer.
      - 2) Product: Kelly Moore - 247 Acry-Shield.
    - b. First and Second Finish Coats
      - 1) 100 percent acrylic semi-gloss enamel applied at spreading rate recommended by the manufacturer.
      - 2) Product: Kelly Moore - 1685 Dura-Poxy+.

- C. Door Trim and Other Metal Surfaces as Approved: Rustoleum semi-gloss.
- D. Exterior Ferrous Metal and Galvanized Metal: Provide the following finish systems over exterior ferrous metal. Primer is not required on shop-primed items. Reprime all areas where primer has been scratched, scraped, or removed.
  - 1. Ferrous and Galvanized Metal Primer
    - a. Factory-formulated rust-inhibitive metal primer applied at spreading rate recommended by the manufacturer.
    - b. Product: Kelly-Moore - 5725 DTM-Acrylic Metal Primer.
  - 2. First Coat
    - a. Factory-formulated semigloss waterborne acrylic-latex enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.6 mils per coat.
    - b. Product: Kelly-Moore - 1250 Acry-Lustre Exterior Semi-Gloss Acrylic Finish.

### 3.04 INTERIOR PAINT SCHEDULE

- A. Gypsum Board
  - 1. Eggshell Finish: 2 finish coats over a primer at offices, entrances and at public areas.
    - a. Primer
      - 1) Latex based, interior primer/sealer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.
      - 2) Product: Kelly Moore - 971 Acry-Prime.
    - b. First and Second Coats
      - 1) Low luster eggshell, acrylic-latex based, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.8 mils.
      - 2) Product: Kelly Moore - 1610 Eggshell.
  - 2. Semigloss Acrylic Enamel Finish: 2 finish coats over a primer at "wet areas" such as restrooms, janitor closets, laboratory classrooms, storage, and prep areas.
    - a. Primer
      - 1) Latex based, interior primer/sealer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.
      - 2) Product: Kelly Moore - 971 Acry-Prime.
    - b. First and Second Coats
      - 1) Semigloss, acrylic latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.6 mils.
      - 2) Product: Kelly Moore - 1650 AcryPlex Latex SemiGloss Enamel.
- B. Ferrous Metal
  - 1. Semigloss, Acrylic Enamel Finish: 2 finish coats over a primer. Primer is not required on shop-primed items.
    - a. Primer
      - 1) Quick drying, rust-inhibitive red oxide metal primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils.
      - 2) Product: Kelly Moore - 1710 KelGard Red Oxide Primer.
    - b. First and Second Coats
      - 1) Semigloss, acrylic latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.3 mils.
      - 2) Product: Kelly Moore - 1650 AcryPlex Latex SemiGloss Enamel.

C. Galvanized Metal

1. Semigloss, Acrylic Enamel Finish: 2 finish coats over a primer.
  - a. Primer
    - 1) Galvanized metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.
    - 2) Product: Kelly Moore - 1722 KelGard Galvanized Primer.
  - b. First and Second Coats
    - 1) Semigloss, acrylic latex interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.6 mils.
    - 2) Product: Kelly Moore - 1650 AcryPlex Latex SemiGloss Enamel.

**END OF SECTION**



**SECTION 10 14 00**

**SIGNAGE**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section Includes: Code required and identification signs as indicated.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

**1.02 REFERENCES**

- A. ADA - Americans with Disabilities Act
- B. CBC - California Building Code, 2007 Edition

**1.03 SYSTEM DESCRIPTION**

- A. Design Requirements
  - 1. Design signs as required by ADA and CBC.
    - a. Type 4 - Infrastructure Room Sign: Room number with Braille, Room Usage.
  - 2. Fabricator shall provide all necessary services, labor, materials, equipment, supervision, and products required to fabricate and install all items included in this Section.
- B. Regulatory Requirements: Comply with CBC requirements for signage, to include Braille.

**1.04 SUBMITTALS**

- A. Product Data: Submit manufacturer's product data describing materials and signs.
- B. Shop Drawings
  - 1. Provide shop drawings showing construction details for approval before proceeding with fabrication. Include full size details of exposed edges, and any other details which would affect sign appearance.
  - 2. Fasteners: Detail methods of fastenings and provide exact specifications for all fasteners noted on shop drawings.
  - 3. Artwork: Submit full size patterns or prints of typical copy layouts and/or graphic elements to be applied on signs. Using layouts on the Drawings as a guide, optically enlarge and hand correct images before submitting to the Architect for approval before fabrication.
  - 4. Sign Location: Provide Graphic Schedule and location plans to identify and locate all signs. Item numbers listed in the Graphic Schedule shall be found on location plans and shall identify locations of specific sign items.
- C. Samples
  - 1. On 6-inch by 6-inch pieces of actual sign materials, submit to the Architect for review and approval, 3 samples of painted and graphic finishes, in each material, color, and finish, with texture to simulate actual conditions.
  - 2. Provide listing of the material and application for each coat of each finish sample.
  - 3. Be prepared to resubmit each sample as requested until required sheen, color, and texture are approved.

4. Acrylic: Submit color and finish samples of plastics for approval before proceeding with fabrication. No substitution in color, thickness, finish, or plastics will be accepted without written approval of the Architect.
5. Fasteners: Submit 1 sample of all fasteners and hardware for approval.
6. Background Color: Cañada Green, "PMS Color 5463."
7. Copy/Dictogram Color: 3M Scotchal Series 220, Premium Film White.

- D. Operation and Maintenance: Provide the District with proper cleaning instructions required for continued maintenance of signs.

#### **1.05 QUALITY ASSURANCE**

- A. Fabricator Qualifications: Fabricator shall have at least 5 years experience in the fabrication and installation of signage of scope and design similar to the required work.

#### **1.06 WARRANTIES**

- A. Fabrication and installation of all items included in this Section shall be guaranteed for a period of 1 year from Final Acceptance by the District against defects in materials or workmanship.
- B. All finishes shall be guaranteed for a period of 5 years from Final Acceptance by the District against fading, cracking, peeling, blistering, and other defects in materials or workmanship.
- C. All vinyl sheet materials shall be warranted for a period of 5 years from Final Acceptance by the District for defects in materials or workmanship.
- D. Warranties noted above shall include all required materials, labor, and associated costs to replace defective components.

### **PART 2 - PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Acceptable Manufacturers: Action Signs; Fabricators able to provide Scotch 3M3D sign systems.
- B. Pursuant to Section 3400 of the Public Contract: 3M Scotchal materials are now in use on the particular public improvement described as San Mateo County Community College District. At each instance in these Specifications that a designated material, product, thing, or service is designated by the brand name 3M Scotchal, items are designated to support the existing signage system that is in place at Cañada College. The Contractor will furnish and apply only 3M Scotchal as required, and no substitutions shall be deemed to be "or equal" or allowed.

#### **2.02 MATERIALS**

- A. Exterior Signage Specifications - Drilled Braille
1. Substrate: Acrylic Faceplate, Rohm & Haas Op3 Non Glare Acrylic 1/8-inch or 1/4-inch thick.
  2. Text: Rowmark ADA Alternative Applique, 1/32-inch.
  3. Braille: 1/16-inch Clear Glass Bead Braille, raised 1/32-inch above substrate.
  4. Painted Background Color: Ellis Paints, Waterborne Acrylic Enamel.
  5. Laminating Adhesive: Sheet adhesive.
  6. Substrate: Acrylic Backplate, 1/8-inch/1/4-inch Acrylite or equivalent.
  7. Mounting: 3M VHB Foam Tape, 1/32-inch thick.

- B. New Building 30 Sign: Individual metal letters with painted finish and font to match Campus Standard.
  - 1. 1-inch thick water jet-cut aluminum plate letters 1 foot-3 inches high.
  - 2. Aluminum alloy 3003, mill finish.
  - 3. Acrylic urethane primer and paint, as manufactured by Matthews Paint Company, (800) 323-6593.
  - 4. Stainless steel threaded stud mounting.
- C. Mounting: On doors and walls in accordance with manufacturer's recommendations.

### **2.03 FABRICATION**

- A. Artwork: Fabricator shall provide signage as indicated and in accordance with District Standards.
- B. Braille is shown on the Drawings for position only. Fabricator is responsible for Contracted Grade 2 Braille translation to meet State of California requirements as needed.
  - 1. Contractor shall be responsible for the accurate translation of all applicable tactile copy to Contracted Grade 2 Braille. All Braille shall be produced in accordance with California Title 24 requirements. Dots shall be 1/10-inch on centers in each cell with 2/10-inch space between cells. Dots shall be raised a minimum of 1/40-inch above the background.
- C. Graphics: All text, arrows, and symbols shall be provided in the sizes, colors, typefaces, and spacing specified in the Drawings and as required by Code. All text shall be a true, clean, digitally or photomechanically accurate reproduction of the typeface(s) specified, with letter spacing and directional arrows.
  - 1. Font: Frutiger Book.

### **2.04 FINISHING**

- A. General
  - 1. All finishes to conform with ADA requirements for contrast, semi-gloss level, and reflectivity. Submit samples as required under "Submittals" article above.
  - 2. Provide uniform finish, color, and appearance in all instances.

## **PART 3 - EXECUTION**

### **3.01 EXAMINATION**

- A. Examine all site conditions, structures, and substrates under which items in this Section are to be installed for suitability to receive the items.
  - 1. Advise Architect of any unsatisfactory conditions.
  - 2. Do not install signage until unsatisfactory conditions have been corrected.
- B. Dimensions shown on the Drawings are for reference only.
  - 1. Field verify all dimensions prior to fabrication and indicate these dimensions on the appropriate shop drawings.
  - 2. Provide templates and patterns for review and to other trades as required to ensure proper fit, alignment, and finish of all work.
- C. Sign Mounting Locations: All signs identifying permanent rooms and spaces shall be located in compliance with CBC 1117B.5.9. Center of sign shall be 5 feet-0 inches above finish floor. Sign to be located at latch side of door, or, if there is insufficient wall space, on the nearest wall, preferably to the right.

**3.02 INSTALLATION**

- A. General
  - 1. Install signage in neat and proper manner.
  - 2. Install sign items, including all components, in accordance with reviewed Graphic Schedule at locations shown.
  - 3. Install signs properly aligned, level and true to line and dimension.
- B. Install with reviewed manufacturer's adhesive or mechanical fasteners after application of finish painting at heights noted.
- C. Damage to the items installed and their surrounding surfaces shall be repaired to the satisfaction of the District, at no additional cost to the District.

**3.03 CLEANING AND PROTECTION**

- A. At completion of installation, clean all sign surfaces in accordance with manufacturer's instructions.
- B. Protect all signs from damage until acceptance by the Architect; repair or replace damaged units as required.
- C. Clean and/or repair all evidence of installation work or damage to adjacent surfaces prior to completion of work.
- D. Remove all protective materials and dispose of properly off site.

**3.04 CONTRACT CLOSE-OUT ITEMS**

- A. Provide District with written instructions for proper cleaning of the signs. Note any solvents that should not be used.

**END OF SECTION**

**SECTION 10 44 00**

**FIRE PROTECTION SPECIALTIES**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section Includes: Fire extinguishers on hooks.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

**1.02 REFERENCES**

- A. ADA - Americans with Disabilities Act
- B. CBC - California Building Code, 2007 Edition
- C. UL - Underwriters Laboratories, Inc.

**1.03 SUBMITTALS**

- A. Product Data: Submit manufacturer's product data for extinguishers showing mounting methods.

**1.04 QUALITY ASSURANCE**

- A. Single-Source Responsibility: Obtain extinguishers from 1 source from a single manufacturer.
- B. UL Listed Products: Fire extinguishers shall be UL listed with UL listing mark for type, rating, and classification of extinguisher.
- C. Regulatory Requirements: Install extinguishers at accessible mounting heights in accordance with ADA and CBC.

**PART 2 - PRODUCTS**

**2.01 MANUFACTURERS**

- A. Acceptable Manufacturers: Larsen's Manufacturing Co.; J. L. Industries, or equal.

**2.02 MATERIALS**

- A. Fire Extinguishers: Multipurpose under pressure, dry chemical type bearing UL rating of 2A-10B:C, 10 pounds nominal capacity, in enameled steel container.
- B. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish as selected by the Architect.

**PART 3 - EXECUTION**

**3.01 INSTALLATION**

- A. Follow manufacturer's printed instructions for installation.
- B. Install in locations and at mounting heights indicated or, if not indicated, at heights to comply with applicable regulations of governing authorities.
  - 1. Fasten mounting brackets to structure, square and plumb.

**END OF SECTION**

**SECTION 22 00 00**

**PLUMBING SYSTEMS**

**PART 1 - GENERAL**

**1.01 GENERAL CONDITIONS**

- A. The General Conditions, Supplementary Conditions, and Division 1 General Requirements apply to the work specified in this Section.

**1.02 WORK INCLUDED**

- A. All materials and operations for a complete and operating plumbing and drainage system, including, but not necessarily limited to, the following:
  - 1. Storm drain piping inside the building including the connection to existing piping.
  - 2. Floor drains.
  - 3. Floor cleanouts.
  - 4. Trenching and backfilling required for plumbing systems.

**1.03 RELATED WORK SPECIFIED ELSEWHERE**

- A. Electrical, Division 26.
- B. Heating, Ventilating, and Air Conditioning Systems, Section 23 00 00.
- C. Trenching, Section 31 23 33.

**1.04 GENERAL REQUIREMENTS**

- A. Verification of Conditions
  - 1. Prior to installation of plumbing work, contractor shall inspect all surfaces to receive said work and arrange with the general contractor for the satisfactory correction of all defects in workmanship and/or material that could interfere with the work specified herein.
  - 2. Installation of any plumbing work or materials on any surface shall constitute acceptance by the contractor of such surfaces as being in proper condition to receive herein specified materials.
- B. Examination of site: Examine site prior to bidding. Compare it with drawings and specifications. Check conditions and take measurements, which may affect work. No allowance shall subsequently be made for any extra expense due to failure to make such examination.
- C. Manufacturer's directions: Follow manufacturer's directions covering points not shown on the drawings or specified herein. Manufacturer's directions do not take precedence over drawings and specifications. Where these are in conflict with drawings and specifications, notify architect for clarifications before installing the work.
- D. Codes: Work and materials shall be in full accordance with all applicable local or state ordinances, California Building Code, California Plumbing Code, National Fire Protection Association, State of California Safety Orders, and State Fire Marshal. Whenever drawings and specifications require larger sizes or higher standards than are required by regulations, drawings and specifications govern. Whenever drawings or specifications require something, which will violate regulations, regulations govern. No extra charge will be paid for furnishing items required by regulations but not specified or shown on drawings.

- E. Cooperation with other trades: Schedule work and cooperate with other divisions to avoid delays, interferences and unnecessary work, conforming to construction schedule, making installation when and where required. A special effort shall be made to coordinate with the mechanical contractor so as not to block installation of the mechanical systems. The clearances above ceilings on this project are limited and the ductwork and piping are to have the highest priority. All plumbing work is to be coordinated with the mechanical contractor such that the ductwork and piping can be installed in the locations shown on the mechanical drawings. If installed work is later found to interfere with work of other divisions, make all necessary changes at contractor's expense.
- F. Licenses, permits, services, and fees: Secure and pay for all licenses required to begin, perform, and complete work.
- G. Quietness of operation: Adjust, repair, or replace any equipment producing objectionable noise or vibration in any occupied areas of building, including providing additional brackets, bracing, etc., to prevent objectionable noise or vibration.
- H. All components of the cold and hot water system are to be in full compliance with CA AB 1953.

#### 1.05 SUBMITTALS

##### A. General:

1. Refer also to Division 1 for additional submittal requirements.
2. When specific names are used in connection with materials, they are used as standards only, but this implies no right to use other materials or methods unless approved by the architect.
3. Decision of the architect shall govern as to what materials are acceptable substitutions. Burden of proof as to equality of any proposed fixtures, material, or equipment shall be upon the contractor. Petition in favor of proposed substitute materials shall be made directly by the contractor. If any tests are necessary to determine quality of proposed items, such tests shall be made at the expense of the contractor by an unbiased laboratory satisfactory to the architect.
4. Submit shop drawings and material list in six (6) copies. Submit material list and shop drawings after official award of contract. Obtain approval of the architect before installation. Shop drawings shall be submitted for all materials, equipment, and controls.
5. Check shop drawings and submittals before forwarding to architect and ascertain that submittals meet all requirements of drawings and specifications and conform to structural space conditions.
6. Shop drawings also shall be prepared for modifications to architectural, plumbing, electrical, and mechanical work required by proposed materials - i.e., relocation of drains, revised electrical circuits, relocation of penetrations, etc.
7. Installation of any approved substituted equipment is the contractor's responsibility and any changes required to work included under other sections for installation of approved substituted equipment must be made to the satisfaction of the architect and without any additional cost. Approval by architect of substituted equipment and/or dimension drawings does not waive these requirements.
8. Review of drawings and materials submitted for approval shall not be construed as a complete check or constitute a waiver of the requirements of the drawings and specifications. This review shall not relieve the contractor of the responsibility to fit the proposed materials to the spaces provided and to effect necessary rearrangement or construction of other work. Contractor agrees that shop drawing submittals processed by the architect do not become contract documents and are not change orders; that the purpose of the shop drawing review is to establish a reporting procedure and is intended for the contractor's convenience in organizing his work and to permit the architect to monitor the contractor's progress and understanding of the design. If deviations, discrepancies, or conflicts between shop drawing submittals and the contract documents are discovered either prior to or after the shop drawing submittals are processed by the architect, the contractor agrees that the contract documents shall control and shall be followed.



9. Submittal lists shall include the identifying marks assigned to the items. Give name of manufacturer, brand name, and catalog number of each item. Submit complete list at one time with items arranged and identified in numerical sequence within each section and article specifications. Listing items "as specified" without both make and model or type designation is not acceptable, except as noted. Only pipe and fittings not specified by brand names may be listed "as specified" without manufacturer's name, provided proposed materials comply with specification requirements.
10. Descriptive Data: Submit six (6) copies of complete description information and performance data covering equipment that is specified but for which catalog plate numbers, brand names, or specific models have not been used.
11. Submittal of substitutions shall be limited to one proposal for each type or kind of item, unless otherwise permitted by the architect.

#### **1.06 DRAWINGS, SPECIFICATIONS, AND COORDINATION OF WORK**

- A. Drawings are essentially diagrammatic. Size and locations of equipment are generally shown to scale. Make use of data in all Contract Documents, and verify this information against field conditions.
- B. The Drawings indicate the required size and point of termination of ductwork, pipes, and equipment. Install pipe with all necessary offsets and fittings to conform to the structure, avoid obstructions, preserve headroom, maintain required accessibility, and satisfy the requirements of the governing codes and the standards of good practice.
- C. The Architectural and Structural Drawings and Specifications take precedence over the Mechanical Drawings in the representation of the general construction work. Refer to the Drawings, Specifications, and review shop drawings for all work in order to coordinate plumbing work with the other work of the project.
- D. Where changes in indicated locations or arrangements are necessary due to conditions in building construction, interference with work in other divisions, or conflict in location, make changes at no cost to the owner deviations, offsets, rises or drops in piping that may be necessary, whether shown or not, shall be made at no expense to owner.
- E. Bring discrepancies between different drawings, between Drawings and actual field conditions, or between Drawings and Specifications promptly to the attention of the architect for decision, and stop all work on affected areas subject to resolution of the conflict.

#### **1.07 MATERIALS AND WORKMANSHIP**

- A. All materials and equipment to be new and in perfect condition. Materials or equipment for similar uses are to be of same type and manufacturer.
- B. Workmanship shall be of best standard practice of the trade.

#### **1.08 PROTECTION OF EQUIPMENT**

- A. The contractor shall be responsible for damage to any of the work of this section until final acceptance. Cover all openings, apparatus, equipment, and appliances both before and after being set in place to prevent misuse or disfigurement of the apparatus, equipment, or appliances.

#### **1.09 OPENINGS**

- A. The contractor shall cooperate with other trades in providing information for openings required in walls, floors, and roof for pipe and equipment.

- B. The contractor shall pay all extra costs for cutting of openings as a result of incorrect, delayed, or neglected information.
- C. Make absolutely watertight any openings through waterproofed construction caused by the penetration of piping and in a manner approved by the architect.

**1.10 CLEAN-UP**

- A. Thoroughly clean all parts of the apparatus and equipment. Exposed parts which are to be painted shall be thoroughly cleaned and all grease and oil spots removed with cleaning solvent.
- B. Remove all debris and surplus equipment and leave installation in perfect condition ready for use.

**1.11 CONSTRUCTION REVIEW**

- A. All services rendered by the Architect or any of his consultants consist of professional opinions and recommendations made in accordance with generally accepted engineering practice.
- B. Under no circumstances is it the intent of the Architect or any of his consultants to directly control the physical activities of the contractor or the contractor's workmen in the accomplishment of work on this project.
- C. The presence of the field representative of the Architect or any of his consultants at the site is to provide to the owner and/or architect an additional source of professional advice, opinions, and recommendations based upon the field representative's observations.

**1.12 SAFETY**

- A. In accordance with generally accepted construction practices, the contractor will be solely and completely responsible for conditions on the jobsite, including safety of all persons and property during performance of the work. This requirement will apply continuously and not be limited to normal working hours.
- B. Construction review by the architect or any of his consultants is not intended to include review of the adequacy of the contractor's safety measures in, on, or near the construction take out extra space site or at any other location.

**1.13 OPERATING INSTRUCTIONS**

- A. Comply with the requirements of Division 1 – General Requirements.
- B. Upon completion of work, the contractor shall place a competent person in charge who will operate the system and instruct the owner's representative in all details of the operation and maintenance of the plumbing system.
- C. The contractor shall carefully prepare four (4) descriptive booklets of the entire plumbing systems and a full description of the operation and maintenance of each piece of equipment.
- D. Operating instructions manuals are to include names, addresses, and telephone numbers for the following: project name, owner, General Contractor, Plumbing Subcontractor, and equipment manufacturer's (including local representatives).

**1.14 GUARANTEE**

- A. The contractor shall furnish a written guarantee to the owner that the new materials, equipment, and installation are new, free from mechanical defects, noiseless, and are in perfect operating condition.
- B. He shall guarantee to replace and repair at his own expense any and all unsatisfactory and defective work and items to the satisfaction of the owner for a period of one (1) year after the system is put to beneficial use.
- C. The contractor shall also furnish the owner with all manufacturer's written guarantees of materials and equipment.
- D. Refer also to Division 1 requirements

#### 1.15 RECORD DRAWINGS

- A. Refer to Division 1 – General Requirements.

### PART 2 - PRODUCTS

#### 2.01 MATERIALS

- A. Storm Drain Piping:
  - 1. Above and Below Grade: No-Hub cast iron soil pipe and fittings. All pipe and fittings shall conform to CISPI 301, ASTM 888 or ASTM A-74 standards. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute. Pipe and fittings are to be manufactured by AB&I Foundry, Charlotte Pipe or Tyler Pipe. Joints shall be made with heavy duty No-Hub couplings. Husky SD4000. Clamp All 125 or MG Coupling. No-Hub couplings shall conform to CISPI Standard 310 and ASTM A 1277. Pipe, fittings and joints shall be manufactured in the U.S.A.
- B. Dielectric Protection:
  - 1. Location: For connection between dissimilar metals in the piping systems to control corrosion caused by galvanic or electrolytic action. No dielectric unions allowed.
  - 2. Listing: Victaulic Style 47, Lochinvar V-line, Waterway or equal.
    - a. Dielectric couplings: Threaded for sizes 2 inches and smaller, grooved or flanged for 2-1/2 inches and larger.
- C. Thread Lubricant For Steel Pipe: Armité Joint Seal Compound No. 250.
- D. Pipe Sleeves: Adjus-To-Crete 24 ga., electrogalvanized sheet metal adjustable sleeve, or equal.
- E. Pipe Hangers and Supports: Superstrut or equal.
  - 1. Plumbing Piping – Soil, Waste, and Vent:
    - a. Conform to ASME B31.9.
    - b. Hangers for Pipe Sizes ½ inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.
    - c. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
    - d. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
    - e. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
- F. Seismic Bracing: Conform to SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems, Second Edition, 1998.
- G. Cleanouts:

1. Zurn, Josam, J.R. Smith or equal, as scheduled on drawings. Cleanouts shall be furnished with flashing collars when installed in membraned slabs. Furnish suitable wrought iron or steel wrenches for each style of cleanout plug cap.
  
- H. Drains: Zurn, Josam, J.R. Smith or equal, as scheduled on drawings. Drains shall be furnished with flashing collars when installed in membraned slabs. Furnish floor drains with trap primer connections. ASME A1123.6.3; lacquered cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer.
  
- I. Piping Identification:
  1. Piping identification shall be manufactured by Marking Services, Incorporated or equal.
  2. Materials:
  3. Color: Unless specified otherwise, conform with ANSI/ASNE A13.1.
  4. Plastic nameplates: Laminated 3-layer plastic with engraved black 2 inch high letters on light contrasting background color.
  5. Metal tags: brass aluminum with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.
  6. Plastic pipe markers: Factory fabricated, flexible, semi-rigid, preformed to fit around pipe or pipe covering, minimum information indicating flow direction arrow and fluid being conveyed.
  
- J. Escutcheon Plates: For pipes passing through finished ceilings, walls, and floors in conspicuous locations, use chromium-plated steel floor and ceiling plates with set screw or other approved means of holding securely in place.
  
- K. Flashing and Counterflashing: For cast iron pipe penetrations through roof, use 4 pound lead flashing with counterflashing. For copper pipe penetrations through roof, use copper flashing and counterflashing.
  
- L. Equipment Scheduled on Drawings – Make and model as scheduled on the drawings or equal:
  1. Floor drains.
  2. Floor cleanouts.

### **PART 3 - EXECUTION**

#### **3.01 GENERAL**

- A. Support exposed and concealed piping on specified hangers properly spaced and set to allow piping to adjust for temperature change expansion and contraction. Evenly space and support piping in parallel.
  
- B. Coordinate with other trades to provide continuous support channel for all pipes and conduit in exposed locations.
  
- C. Conceal piping in ceilings, furred walls, partitions and pipe spaces, except where noted otherwise. Provide maximum head room and run piping to maintain proper clearance for piping runs beforehand and with other divisions to insure clearance. Where work of other divisions prevents installation of piping shown on drawings, reroute piping as directed by architect at no extra cost to owner.
  
- D. Install exposed piping parallel to or at right angles with building walls.
  
- E. No valve, piece of equipment, or trim shall support the weight of any pipe. Install valves, traps, cleanouts, etc., in accessible locations.
  
- F. Install piping free from traps and air pockets.
  
- G. Wherever changes in sizes of piping occur, use reducing fittings.

- H. Install unions adjacent to threaded valves, equipment, and at other points where required for disassembly.
- I. Provide sleeves wherever pipes run through walls, slabs, beams, footings, and floors large enough for passage of pipe and/or pipe insulation. Sufficiently size sleeves to allow for contraction and expansion of pipe. Pack sleeves with approved packing material. Pack sleeves in walls and slabs below grade and through exterior walls above grade with waterproof mastic or grout.
- J. Set floor cleanouts so top of plate and rim will be flush with top of finish flooring.
- K. Where sleeves are missed or misplaced during canning, core holes with rotary diamond tooth core drills.
- L. Fit exposed pipes, which pass through walls, ceilings, or floors in finished rooms and conspicuous locations with escutcheon plates.
- M. Install insulating unions or flanges at ferrous and nonferrous piping connections.

### 3.02 PIPE HANGERS, SUPPORTS, AND BRACES

- A. General: Support piping from building structure so that there is no apparent deflection in piping runs. Fit piping with steel sway braces and anchors to prevent vibration and/or horizontal displacement under load when required. Support piping only by approved pipe hangers. Pipes shall not be supported from, or braced to, ducts, other pipes, conduits, or any materials except building structure. Piping or equipment shall not be supported or hung by wire, rope, plumbers tape, or blocking of any kind.
- B. Hanger spacing (not for piping or multiple piping supports):

<u>Type of Pipe</u>	<u>1-1/2" diam. &amp; smaller</u>	<u>2" diam. &amp; lgr</u>
Cast iron pipe	All sizes 5'- 0" max. and not less than one hanger per joint	
- C. Piping at completion of job shall be rigid and immobile. Install additional pipe supports, brackets, and hangers as required to accomplish a rigid and immobile piping system.

### 3.03 EXCAVATING, TRENCHING, AND BACKFILLING

- A. Trenches: Shall have uniform grades. In case of over excavation, fill to bottom of pipe with selected fill or sand. Provide dewatering pumping as required.
- B. Shoring: Comply with earthwork section of specifications.
- C. Cleaning of Trenches: After pipe lines have been tested, inspected, and approved, and prior to backfilling, remove forms, trash, and debris from trenches, then backfill.
- D. Backfill and Compaction: Comply with earthwork section of specifications.

### 3.04 CLEANING

- A. Thoroughly clean exterior and interior of piping, equipment, and materials before systems are put in operation. Clean plumbing fixtures with soap and water. Remove marks and labels. Clean and polish chrome. Remove paint, concrete, plaster, and other foreign materials. Clean valve handles and stems of any paint, dirt, or other foreign materials. Clean drains of dirt and debris. Remove shipping paper from cleanout covers and polish. Remove and clean out dirt and debris from pipe spaces, including wire and blocking.

**3.05 TESTING**

- A. Storm drain piping: Test with minimum height of stand pipe 10'-0". Test duration to be a minimum of four (4) hours.
- B. If systems are tested in sections, include connection to previously tested section. Final pressures at end of test period shall be no more nor less than that caused by expansion or contraction of test medium due to temperature changes. Apply tests for a minimum period of four (4) hours or as required by local codes or agencies having jurisdiction. Where testing pressures are higher than rated pressure for equipment, or special trim, remove and bypass item with temporary piping for purposes of test.
- C. Testing shall be done in the presence of the Owner's representatives.

**3.06 PIPING IDENTIFICATION**

- A. Installation:
- B. Degrease and clean surfaces to receive adhesive for identification materials.
- C. Plastic nameplates: Install with corrosive-resistant mechanical fasteners or adhesive.
- D. Plastic pipe markers: Install in accordance with manufacturer's instructions. Maximum spacing is to be twenty (20) feet on center.
- E. Valves: Identify valves in main and branch piping with tags.
- F. All exposed piping and piping above accessible ceilings shall be neatly identified spaced not more than twenty (20) feet on center.

**END OF SECTION**

**SECTION 23 00 00**

**HEATING, VENTILATING, AND AIR CONDITIONING SYSTEM**

**PART 1 - GENERAL**

**1.01 GENERAL CONDITIONS**

- A. The General Conditions, Supplementary Conditions, and Division 1, General Requirements apply to the work specified in this section.

**1.02 SUMMARY**

- A. The work shall consist of furnishing all labor, materials, and equipment required to complete the installation of the heating, ventilating, and air conditioning systems as indicated on the drawings and described herein, including all incidental work necessary to make it complete and satisfactory and ready for operation. Work shall include, but not be limited to, the following principal items:
  - 1. Demolition of certain duct, supports and related accessories.
  - 2. Duct systems, complete with necessary volume dampers, access doors, hangers, supports, and accessories for the following service:
    - a. Air supply systems.
    - b. Outside air intake systems.
  - 3. Insulation, lining, and covering for duct and fittings.
  - 4. Access panels and doors in ductwork and sheet metal plenums.
  - 5. Access panels in ceiling and drywall enclosures, which relate to this trade and coordination for the proper location of the panels.

**1.03 RELATED WORK**

- A. Electrical, Division 26.
- B. Firestopping.

**1.04 GENERAL REQUIREMENTS**

- A. Verification of Conditions: Prior to installation of heating, ventilating and air conditioning work, contractor shall inspect all surfaces to receive said work and arrange with the general contractor for the satisfactory correction of all defects in workmanship and/or material that could interfere with the work specified herein. Installation of any air conditioning work or materials on any surface shall constitute acceptance by the contractor of such surfaces as being in proper condition to receive herein specified materials.
- B. Compliance with Codes: All work must comply with requirements of all applicable codes, laws, ordinances, and regulations of all authorities having jurisdiction.
- C. Reference Standards: Published specifications, standards, tests, or recommended method of trade, industry, or governmental organizations apply to work of this Section where cited below:
  - 1. Air Moving and Conditioning Association (AMCA).
  - 2. American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE).
  - 3. American Society of Mechanical Engineers (ASME).
  - 4. American Society of Plumbing Engineers (ASPE).
  - 5. Associated Air Balance Council (AABC).

6. National Electrical Manufacturers Association (NEMA).
  7. National Fire Protection Association (NFPA).
  8. Sheet Metal and Air Conditioning Contractors National Association (SMACNA).
  9. California Building Code (CBC).
  10. State of California - OSHA.
  11. California Mechanical Code (CMC).
  12. 2008 California Building Energy Efficiency Standards (Title 24).
  13. The State of California Codes and Safety Orders.
  14. State Fire Marshal requirements (SFM).
  15. Air Conditioning and Refrigeration Institute (ARI).
  16. State of California Environmental Quality Act.
  17. American Society of Testing and Materials (ASTM).
  18. Underwriters Laboratories (UL).
  19. Occupational Safety and Health Act (OSHA).
  20. National Bureau of Standards (NBS).
  21. American National Standards Institute (ANSI).
  22. AMCA Standard 99: Standards Handbook.
  23. AMCA/ANSI Standard 204: Balance Quality and Vibration Levels for Fans.
  24. AMCA Standard 210: Laboratory Methods of Testing Fans for Ratings.
  25. AMCA Standard 300: Reverberant Room Method for Sound Testing of Fans.
  26. AMCA Standard 500: Test Methods for Louvers, Dampers and Shutters.
  27. ARI Standard 410: Forced-Circulation Air-Cooling and Air-Heating Coil.
  28. ANSI/ASHRAE 15: Safety Code for Mechanical Refrigeration.
  29. ASHRAE Standard 52: Gravimetric and Dust Spot Procedures for Testing Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter.
  30. ASHRAE/ANSI Standard 111: Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning and Refrigeration Systems.
  31. ASME Section VIII: Unified Pressure Vessel Code.
  32. UL Standard 1995: Heating and Cooling Equipment.
  33. ASTM A-525: Specification for General Requirements for Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process.
  34. ASHRAE Standards 62-2007: Ventilation for Acceptance Indoor Air Quality.
  35. ANSI/ASHRAE Standard 55-2007: Thermal Environmental Conditions for Human Occupancy.
- D. Licenses: Shall be obtained and paid for by this contractor.
- E. Examination of Drawings and Existing Conditions: The contractor shall carefully study the mechanical, architectural, structural, and electrical drawings. He shall make himself thoroughly familiar with all requirements. He shall verify existing conditions and compare with the new work required. Any discrepancies shall be brought to the architect's immediate attention. No extra compensation will be allowed for extra work for the contractor's failure to follow this direction.
- F. Substitutions, Material List, Shop Drawings:
1. Refer also to Division 1 for additional submittal requirements.
  2. When specific names are used in connection with materials, they are used as standards only, but this implies no right to use other materials or methods unless approved by the architect.
  3. Decision of the architect shall govern as to what materials are acceptable substitutions. Burden of proof as to equality of any proposed fixtures, material, or equipment shall be upon the contractor. Petition in favor of proposed substitute materials shall be made directly by the contractor. If any tests are necessary to determine quality of proposed items, such tests shall be made at the expense of the contractor by an unbiased laboratory satisfactory to the architect.
  4. Submit shop drawings and material list in six (6) copies. Submit material list and shop drawings after official award of contract. Obtain approval of the architect before installation. Shop drawings shall be submitted for all materials, equipment, and controls.



5. Check shop drawings and submittals before forwarding to architect and ascertain that submittals meet all requirements of drawings and specifications and conform to structural space conditions.
  6. Shop drawings also shall be prepared for modifications to architectural, plumbing, electrical, and mechanical work required by proposed materials - i.e., relocation of drains, revised electrical circuits, relocation of penetrations, gas pipe sizing changes, etc.
  7. Installation of any approved substituted equipment is the contractor's responsibility and any changes required to work included under other sections for installation of approved substituted equipment must be made to the satisfaction of the architect and without any additional cost. Approval by architect of substituted equipment and/or dimension drawings does not waive these requirements.
  8. Review of drawings and materials submitted for approval shall not be construed as a complete check or constitute a waiver of the requirements of the plans and specifications. This review shall not relieve the contractor of the responsibility to fit the proposed materials to the spaces provided and to effect necessary rearrangement or construction of other work. Contractor agrees that shop drawing submittals processed by the engineer do not become contract documents and are not change orders; that the purpose of the shop drawing review is to establish a reporting procedure and is intended for the contractor's convenience in organizing his work and to permit the engineer to monitor the contractor's progress and understanding of the design. The process of review of the contractor's submittals is not for the purpose of testing the engineer's perception. If deviations, discrepancies, or conflicts between shop drawing submittals and the contract documents are discovered either prior to or after the shop drawing submittals are processed by the engineer, the contractor agrees that the contract documents shall control and shall be followed.
  9. Submittal lists shall include the identifying marks assigned to the items. Give name of manufacturer, brand name, and catalog number of each item. Submit complete list at one time with items arranged and identified in numerical sequence within each section and article specifications. Listing items "as specified" without both make and model or type designation is not acceptable, except as noted. Only pipe and fittings not specified by brand names may be listed "as specified" without manufacturer's name, provided proposed materials comply with specification requirements.
  10. Descriptive Data: Submit six (6) copies of complete description information and performance data covering equipment that is specified but for which catalog plate numbers, brand names, or specific models have not been used. Include fan performance curves.
  11. Submittal of substitutions shall be limited to one proposal for each type or kind of item, unless otherwise permitted by the architect.
- G. Drawings, Specifications, and Coordination of Work:
1. Drawings are essentially diagrammatic. Size and locations of equipment are generally shown to scale. Make use of data in all Contract Documents, and verify this information against field conditions.
  2. The Drawings indicate the required size and point of termination of ductwork, pipes, and equipment. Install pipe with all necessary offsets and fittings to conform to the structure, avoid obstructions, preserve headroom, maintain required accessibility, and satisfy the requirements of the governing codes and the standards of good practice.
  3. The Architectural and Structural Drawings and Specifications take precedence over the Mechanical Drawings in the representation of the general construction work. Refer to the Drawings, Specifications, and review shop drawings for all work in order to coordinate mechanical work with the other work of the project.
  4. Where changes in indicated locations or arrangements are necessary due to conditions in building construction, rearrangement of equipment, or conflict in location, make such changes at no cost to the owner, provided that the change is ordered before pipe ductwork and/or equipment is installed and that the length of run is not revised by more than 5 percent of the indicated run.
  5. Bring discrepancies between different drawings, between Drawings and actual field conditions, or between Drawings and Specifications promptly to the attention of the architect/engineer for decision, and stop all work on affected areas subject to resolution of the conflict.

- H. Materials and Workmanship:
1. All materials and equipment to be new and in perfect condition. Materials or equipment for similar uses are to be of same type and manufacturer.
  2. Workmanship shall be of best standard practice of the trade.
- I. Protection of Equipment:
1. The contractor shall be responsible for damage to any of the work of this section until final acceptance. Cover all openings, apparatus, equipment, and appliances both before and after being set in place to prevent misuse or disfigurement of the apparatus, equipment, or appliances.
- J. Openings:
1. The contractor shall cooperate with other trades in providing information for openings required in walls, floors, and roof for ducts and equipment.
  2. The contractor shall pay all extra costs for cutting of openings as a result of incorrect, delayed, or neglected information.
  3. Make absolutely watertight any openings through waterproofed construction caused by the penetration of ductwork or piping and in a manner approved by the architect.
- K. Clean-up:
1. Thoroughly clean all parts of the apparatus and equipment. Exposed parts which are to be painted shall be thoroughly cleaned of cement, plaster, mastic, and other materials, and all grease and oil spots removed with cleaning solvent.
  2. Inside of all pipes, ducts, etc. shall be flushed or cleaned before being placed in operation, and all strainers shall be cleaned after operational tests.
  3. Remove all debris and surplus equipment and leave installation in perfect condition ready for use.
- L. Construction Review:
1. All services rendered by the Architect or any of his consultants consist of professional opinions and recommendations made in accordance with generally accepted engineering practice.
  2. Under no circumstances is it the intent of the Architect or any of his consultants to directly control the physical activities of the contractor or the contractor's workmen in the accomplishment of work on this project.
  3. The presence of the field representative of the Architect or any of his consultants at the site is to provide to the owner and/or architect an additional source of professional advice, opinions, and recommendations based upon the field representative's observations.
- M. Safety:
1. In accordance with generally accepted construction practices, the contractor will be solely and completely responsible for conditions on the jobsite, including safety of all persons and property during performance of the work. This requirement will apply continuously and not be limited to normal working hours.
  2. Construction review by the engineer or any of his consultants is not intended to include review of the adequacy of the contractor's safety measures in, on, or near the construction site or at any other location.
- N. Guarantee:
1. The contractor shall furnish a written guarantee to the owner that the new materials, equipment, and installation are new, free from mechanical defects, noiseless, and are in perfect operating condition.
  2. He shall guarantee to replace and repair at his own expense any and all unsatisfactory and defective work and items to the satisfaction of the owner for a period of one (1) year after the system is put to beneficial use.
  3. The contractor shall also furnish the owner with all manufacturer's written guarantees of materials and equipment.
  4. Refer also to Division 1 requirements

- O. Record Drawings: See Division 1.
  - 1. Refer to Division 1 – General Requirements.

## **PART 2 - PRODUCTS**

### **2.01 MATERIALS**

- A. Access Doors:
  - 1. General: All concealed valves, controls, fire dampers, volume dampers, etc., shall be provided with access doors which shall be furnished under the work of this section and installation shall be the responsibility of the general contractor. Access doors are not required in removable ceilings. Access doors which provide access to fire dampers are to be labeled with one-half inch (1/2") high letters reading "Fire Damper."
  - 2. Access doors shall be bonderized steel, with flush screwdriver operated cam latch, fitted with concealed hinges, factory prime coated. Doors shall be Milcor, or approved equal, Style "A" for acoustical tile, Style "B" for acoustical plaster, Style "K" for nonacoustical plaster, and Style "M" elsewhere, 24" square unless otherwise noted on the drawings. Access doors in 1 or 2-hour construction shall be Milcor or equal U/L "B" label doors.

### **2.02 SYSTEMS**

- A. Duct Systems:
  - 1. Sheet Metal Work - (2500 FPM, +2.0" SP to -2.0" SP): Supply air and outside air intake duct systems:
    - a. General: Duct shall be round spiral lock seam or rectangular galvanized steel construction.
    - b. Duct Construction:
      - 1) General: Construction shall be in accordance with the latest ASHRAE Standards, SMACNA 1995 Second Edition HVAC Duct Construction Standards with 1997 Addendum 1, California State Building Code, and the Title 24 energy standards.
      - 2) All duct joints and seams are to be constructed to meet the requirements of the SMACNA 1995 Second Edition Duct Construction Standards with 1997 Addendum 1. Manufactured joints, such as Ductmate or TDC, are to be installed in strict accordance with the manufacturer's installation requirements.
      - 3) Care shall be taken to ensure that all duct reinforcing requirements are met.
      - 4) All 90° branch fittings for round ducts are to be of the conical tee type, conical saddle tap, or as detailed on the Drawings.
      - 5) All spiral duct and fittings inside buildings to be United McGill, Uni-Seal, or approved equal.
      - 6) Spiral duct joints for diameters up to 36" are to be fabricated using sleeve type couplings. Galvanized steel "Uni-Rings" or angle iron rings are to be used for joints on ducts 36" diameter and larger.
      - 7) Commercial gauge adjustable elbows may be used in concealed areas for duct sizes up through 14" diameter. For duct sizes greater than 14" diameter and where duct is exposed, elbows shall be United McGill "Uni-Seal" gored elbows or approved equal.
      - 8) All spiral round duct shall be installed in strict accordance with the manufacturer's requirements.
      - 9) All rectangular duct, fittings and plenums are to be constructed in accordance with SMACNA 1995 Second Edition Duct Construction Standards with 1997 Addendum 1.
      - 10) All roof mounted ducts or ducts exposed to weather are to have flanged and gasketed longitudinal joints; Ductmate TDC or TDF.
      - 11) Non-radius, square heel and throat rectangular elbows, with or without turning vanes, are not acceptable unless specifically shown on the drawings.
      - 12) All elbows and bends are to be made with the minimum inside radius equal to 1.5 times the duct diameter or centerline radius ( $R/W=1.5$ ), where possible. If field conditions do

not allow 1.5 inside radius, provide elbow and bend radius as long as possible. Elbow and bend radius shall be no less than that shown on the drawings. All conditions with less than 1.5 inside radius must be approved by the Architect, prior to fabrication and/or installation.

13) All radius elbows in rectangular ductwork are to include one (1) splitter vane, located at a distance of 1/3 of the duct width as measured in from the elbow throat.

c. Ducts are to be sealed so as to conform to SMACNA Duct Seal Class C. Duct tape as a sealant is not acceptable. A brush applied, high pressure duct sealant is to be utilized, MEI or approved equal. Sealant is to be verified that it is suitable for painting. Duct sealant is to be applied in complete accordance with the manufacturer's application instructions.

2. General:

a. Access Doors: Doors in sheet metal ducts and plenums for access to dampers, extractors and equipment shall be No. 18 gauge, and made airtight by means of felt strips. Doors shall be sized as required for reasonable service access. Minimum size shall be 12" x 12" unless limited by duct size.

1) Fabricate in accordance with SMACNA Duct Construction Standards and as indicated.

2) Review locations prior to fabrications.

3) Fabricate rigid and close-fitting doors of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ductwork, install minimum 1 inch thick insulation with metal cover.

4) Access doors smaller than 12 inches square may be secured with sash locks.

5) Provide 2 hinges and 2 sash locks for sizes up to 18 inches square, 3 hinges and 2 compression latches with outside and inside handles for sizes up to 24 x 18 inches.

6) Access doors with sheet metal screw fasteners are not acceptable.

b. Balancing Dampers: Shall be furnished and installed where required to completely balance and otherwise adjust the air quantities to each supply and return outlet, branch duct and exhaust grille. Manual balance dampers shall be provided in each branch duct. Balancing dampers shall not be installed in the collar of any flexible duct. No balancing dampers are to be installed in grease exhaust ducts.

1) Balancing dampers in rectangular ducts:

a) Ruskin Model CD50 or equal low leakage damper with airfoil type extruded aluminum blade with a maximum depth of 6" and with an integral structural reinforcing tube running full length of each blade. Blade edge seals shall be extruded vinyl double edge design with inflatable pocket. Linkage shall be concealed in frame damper manufacturer's literature shall include performance data developed from testing accordance with AMCA Standard 500 in an AMCA approved laboratory showing pressure drop for all sizes of dampers required at all anticipated airflow rates.

2) Balancing dampers in round ducts:

a) Fabricate in accordance with SMACNA Duct Construction Standards and as indicated.

b) Shall be furnished and installed where required to completely balance and otherwise adjust the air quantities to all supply and return outlets, branch ducts, and exhaust grilles. Manual balance dampers shall be provided in each branch duct. Damper to be one gauge heavier than the duct gauge. Provide Jiffy Bearings JB-1 damper hardware or equal.

c) Except in round ductwork 12 inch and smaller, provide end bearings. On multiple blade dampers, provide oil impregnated nylon or sintered bronze bearings.

d) On insulated ducts, mount quadrant regulators on stand-off mounting brackets, bases or adaptors.

B. Mechanical Systems Insulation:

1. Supply and outside air intake duct and fittings:

- a. General:
    - 1) Adhesives and insulation materials: Composite fire and smoke hazard ratings maximum 25 for Flame Spread and 50 for Smoke Developed. Adhesives to be waterproof.
    - 2) Anti-microbial agent surface coating: EPA-registered biocide, ASTM C-1338, ASTM G-21, ASTM G-22.
  - b. Insulation shall be provided on all ductwork where shown on the drawings and on all supply, return, and outside air duct, except where exposed.
  - c. Ductwork: Cover all sides with 1-1/2 inch thick, 3/4 pounds per cubic foot density duct wrap with foil scrimkraft or equal, applied per the manufacturer's application specification. Note that foil scrimkraft is not required to be sealed as a vapor barrier. Johns Manville Microlite XG formaldehyde-free Type 75 FSK, Certainteed SoftTouch Type 75 FSK, or equal.
  - d. 2" Duct liner: Supply and return air ducts where shown on the drawings to be internally lined with 2" liner, shall be lined in the interior with 2 inch thick fiberglass duct liner; NRC=1.00 acoustical performance (Type "A" mounting). Lined ducts need not be covered. Liner to be Johns Manville Permacote Linacoustic Standard, Certainteed Type 150 ToughGard R with Enhanced Surface, or equal.
  - e. 1" Duct liner: Supply, return, and exhaust air ducts where shown on the drawings to be internally lined with 1" liner are to be internally lined with 1 inch thick, 1.5 pounds per cubic foot duct liner. Duct liner shall be installed in complete accordance with the manufacturer's installation instructions. Ducts shall be increased in size to accommodate lining without loss of area. Liner to be Johns Manville Permacote Linacoustic Standard, Certainteed Type 150 ToughGard R with Enhanced Surface, or equal.
- C. Seismic Restraint Systems:
1. All mechanical system components including, but not limited to, air ducts and piping, shall have seismic restraints as required to meet the requirements of Title 24, Chapter 23, of the California State Building Code.
  2. Pipes, ducts, and conduits shall be supported and braced per OSHPD anchorage Pre-approved No. OPA-0300 Tolco Seismic Restraint Systems Guidelines. Once the exact location of all pipes and ducts has been established, the structural engineer must check the adequacy of the supporting structure to ensure that the original design is still adequate.
  3. All fixed equipment is required to be seismically supported, mounted, and restrained. Supports and anchorage details along with substantiating calculations are required for the following:
    - a. Equipment with operating weight over 500 pounds that is mounted directly on the floor or roof.
    - b. Equipment with an operating weight over 20 pounds that is suspended from the roof, floor or wall or that is supported by vibration isolation devices.
  4. It shall be the contractor's responsibility to furnish and install all required seismic bracing, supports for all equipment, piping and duct systems required to meet the above-referenced sections of Title 24 of the California Administrative Code. No attempts have been made to identify all of the locations and details of the required supports. The method and details are at the contractor's option, using the guidelines referred to in Paragraph 2. above.

### **PART 3 - INSTALLATION**

#### **3.01 GENERAL**

- A. For the actual fabrication, installation, and testing of work under this Section, use only thoroughly trained and experienced workmen who are properly qualified for the work they perform. All installers are to be completely familiar with the manufacturer's current recommended methods of installation and shall so execute.

### 3.02 DUCTWORK AND ACCESSORIES

#### A. Installation:

1. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
2. Connect diffusers to low pressure ducts in concealed locations with 5 feet maximum length of flexible duct. Hold in place with strap or clamp to prevent duct from collapsing above diffuser.
3. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing.
4. Provide fire dampers and fire/smoke dampers at locations indicated. Install with required perimeter mounting angles, sleeves, breakaway duct connection, corrosion resistant springs, bearings, bushings, and hinges. Follow the manufacturer's installation instructions.
5. Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment.
6. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, and fire/smoke dampers and elsewhere as indicated. Provide minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, and as indicated.
7. Provide duct test holes where indicated and required for testing and balancing purposes.
8. Check location of outlets and inlets and make necessary adjustments in position to conform with Architectural features, symmetry, and lighting arrangement.
9. Install diffusers to ductwork with airtight connection.
10. Paint ductwork visible behind air outlets and inlets matte black.

### 3.03 MECHANICAL SYSTEM AND EQUIPMENT INSULATION

#### A. Install all insulation in strict accordance with the manufacturer's installation instructions and Specifications.

#### B. Ductwork:

1. Do not install covering before ductwork and equipment has been tested, and accepted by the Architect.
2. Ensure surface is clean and dry prior to installation. Ensure insulation is dry before and during application.
3. Ensure insulation in continuous through inside walls. Pack around ducts with fireproof, self-supporting insulation material, properly sealed.
4. Finish insulation neatly at hangers, supports, and other protrusions.
5. Repair separation of joints or cracking of insulation due to thermal movement or poor workmanship.
6. Follow the manufacturer's installation instructions and recommendations for each insulation type.

### 3.04 SUPPORTS AND ANCHORS

#### A. Fabrication:

1. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
2. Design hangers without disengagement of supported pipe.
3. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

### 3.05 SYSTEM TEST AND STARTUP

#### A. Check the installation and connection requirements for conformance with the manufacturer's installation instructions for each piece of equipment. Perform the step-by-step checkout and startup procedures for each piece of equipment in accordance with the manufacturer's startup instructions.

- B. Make all necessary control and system adjustments and operate the system in its final configuration for a period of one (1) working day for the purpose of proving satisfactory performance. During this period, instruct such persons as owner may designate in proper operation, care, and maintenance of the systems.

**END OF SECTION**

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**SECTION 25 55 00**

**BUILDING MANAGEMENT AND CONTROL SYSTEM (BMS)**

**PART 1 – GENERAL**

**1.01 SUMMARY**

- A. Description: Furnish all labor, materials, equipment, and service necessary to design, program, install and commission a complete and operating facility management and control system. The system shall be fully compatible throughout the Campus and shall utilize Direct Digital Controls, pneumatic/electronic interfaces and actuation devices, as described within the bid package and as additionally described herein. The BMS shall be capable of total integration of the facility infrastructure systems with user access to all system data either locally or over a secure Intranet within the building or by remote access utilizing a standard Web Browser (MS Explorer 6.0) over the Internet. This shall include the ability to perform HVAC control, electrical, gas and water metering, energy management, alarm monitoring, security and personnel access control, fire and life safety systems and all trending, reporting and maintenance management functions related to normal building operations.
- B. The Drawings, Diagrams, Points Lists and Schematics are diagrammatic only and are intended to describe the overall concept and magnitude of the project. All labor, material, equipment and software not specifically referred to herein or on the Drawings, Diagrams, Points Lists and Schematics, that are required to meet the functional intent, shall be provided without additional cost to the Owner. The Contractor shall provide for all power required for control devices as well as structural support and attachments with any calculations and drawings required for permitting
- C. All labor, material, equipment and software not specifically referred to herein that are required to meet the functional intent of this specification, shall be provided without additional cost to the owner.

## 1.02 SYSTEM DESCRIPTION, GENERAL

- A. The entire BMS shall be comprised of a network of interoperable, stand-alone digital controllers communicating on an open protocol communication network to a host computer within the facility and communicating via the intranet to a host computer in a remote location.
- B. The BMS shall be able to communicate to third party systems such as chillers, boilers, air handling systems, energy metering systems and other energy management systems, access control systems, fire-life safety systems and other building management related devices with open interoperable communication capabilities.
- C. The BMS devices for this project shall be able to be part and fully interoperate with the existing T.A.C. Enterprise Server Building Control Wide Area Network existing throughout the District, without having to use additional programming and configuration software

Pursuant to Section 3400 of the Public Contract: T.A.C. Enterprise Server Building Control Wide Area Network and Web Interface Systems is now in use on the particular public improvement described as San Mateo County Community College District. At each instance in these specifications that “T.A.C. Enterprise Server Building Control Wide Area Network and Web Interface Systems” is designated by brand name, said manufacturer’s system is required and is designated to coordinate with existing systems that are in place at Skyline College, College of San Mateo, Cañada College and the District Administration Building. The Contractor will furnish and install only “T.A.C. Enterprise Server Building Control Wide Area Network and Web Interface Systems” systems and devices as required, and no substitutions shall be deemed to be “or equal” or allowed.

## 1.03 SUBMITTALS

- A. A detailed work plan, phasing plan and proposed implementation schedule shall be submitted within 90 days of contract award.
- B. Six copies of shop drawings of proposed system architecture and proposed products and equipment utilized in control system shall be submitted. The shop drawings shall consist of a complete list of equipment and materials, including manufacturers catalog data sheets and installation instructions. Shop drawings shall also contain complete wiring and schematic diagrams, software descriptions, calculations, and any other details required to demonstrate that the system will properly function as intended. At the time each modernization project is contracted and in coordination with the efforts of the respective contractors on the modernization work, shop drawings shall be prepared and forwarded to the

General Contractor for the work related to that contract. The shop drawings shall respect the timing and sequencing of the General Contractor's schedule for submittals, and shall be complete in all respects for the scope of work under which the specific General Contractor would be responsible. Additionally, the shop drawings shall address how the control systems depicted would interface with and integrate with the overall system. Terminal identification for all control wiring shall be shown on the shop drawings. A complete written Sequence of Operation as well as a hard copy graphical depiction of the application control programs shall also be included with each submittal package.

- C. Submittals shall also include a trunk cable schematic diagram depicting the Graphical User Interface (GUI) computer, control panel locations and a description of the communication type, media and protocol.
- D. Upon completion of the work, provide a complete set of 'as-built' drawings and application software on compact disk. Drawings shall be provided as AutoCAD™ files.

#### 1.04 RELATED WORK SPECIFIED UNDER SEPARATE SECTIONS

- A. Division 22, Plumbing, and Division 23, Heating, Ventilating & Air Conditioning:
  - Providing taps and installation of wells in piping for control system sensors and flow measurement devices.
  - Installation of any control system dampers.
- B. Division 25, Integrated Automation, and Division 26, Electrical:
  - Providing motor starters and disconnect switches (unless otherwise noted).
  - Provision, installation and wiring of smoke detectors (unless otherwise noted).
  - Provide power to all DDC control panels

#### 1.05 AGENCY AND CODE APPROVALS

- A. All products of the BMS shall be provided with the following agency approvals. Verification that the approvals exist for all submitted products shall be provided with the submittal package. Systems or products not currently offering the following approvals are not acceptable.
  - UL-916; Energy Management Systems
  - ULC; UL - Canadian Standards Association
  - FCC, Part 15, Subpart J, Class A Computing Devices

#### 1.06 SOFTWARE LICENSE AGREEMENT

- A. The Owner shall sign a copy of the manufacturer's standard software and firmware licensing agreement as a condition of this contract. Such license shall grant use of all programs and application software to Owner as defined by the manufacturer's license agreement, but shall protect manufacturer's rights to disclosure of trade secrets contained within such software.

#### 1.07 DELIVERY, STORAGE AND HANDLING

- A. Provide factory-shipping cartons for each piece of equipment and control device. Maintain cartons through shipping, storage, and handling as required to prevent equipment damage. Store equipment and materials inside and protected from weather.

#### 1.08 JOB CONDITIONS

- A. Cooperation with Other Trades: Coordinate the Work of this section with that of other sections to insure that the Work will be carried out in an orderly fashion. It shall be this Contractor's responsibility to check the Contract Documents for possible conflicts between his Work and that of other crafts in equipment location, pipe, duct and conduit runs, electrical outlets and fixtures, air diffusers, and structural and architectural features.

#### 1.09 QUALITY ASSURANCE

- A. The Manufacturer of the Temperature Control System shall provide documentation supporting compliance with ISO-9001 (Model for Quality Assurance in Design/Development, Production, Installation and Servicing). Product literature provided by the temperature control system manufacturer shall contain the ISO-9001 Certification Mark from the applicable registrar.

## 1.10 QUALIFICATIONS OF BIDDER

- A. All bidders must be temperature control contractors in the business of installing direct digital temperature controls for five (5) years.
- B. All bidders must have installed and completed at least five (5) direct digital temperature control jobs of similar design equipment as specified.
- C. All bidders must be able to provide 24 hour service with 2 hour response time. This scope is provided under a separate contract.
- D. All bidders must be an authorized distributor of the pre-qualified manufacturers specified and listed below.
- E. All bidders must have capabilities of doing component level repairs on electronic systems.
- F. Complete turnkey in-house staff for: Installation, Engineering, Programming, Test, Training, and Check-out.
- G. The following bidder and product is pre-qualified:
  - 1. ENTERPRISE SERVER Web Interface System - Installed by T.A.C. Controls  
  
Schneider Electric  
Chris Wilkins  
[chris.wilkins@buildings.schneider-electric.com](mailto:chris.wilkins@buildings.schneider-electric.com)  
1555 Bayshore Highway, Suite 200, Burlingame, CA 94010, USA  
(650) 616-7403

## PART 2 - MATERIALS

### 2.01 GENERAL

- A. The BUILDING MANAGEMENT AND CONTROL SYSTEM (BMS) shall be comprised of a network of interoperable, stand-alone digital controllers, host computer system(s) with GUI software, portable operator's terminals, modems, printers and other devices as specified herein.
- B. The installed system shall provide secure password access to all features, functions and data contained in the overall BMS.
- C. Specification Nomenclature:

BMS	BUILDING MANAGEMENT AND CONTROL SYSTEM
NAC	Network Area Controller
SDC	Standalone Digital Controller
IDC	Interoperable Digital Controller
IA	IA Series, Interoperable LONMARK Controller
LIDC	Lighting Interface Digital Controller
WBI	Web Browser Interface
POT	Portable Operator's Terminal
POI	Power Measurement Interface
DDC	Direct Digital Controls
LAN	Local Area Network
WAN	Wide Area Network
OOT	Object Oriented Technology
PICS	Product Interoperability Compliance Statement
GP	Graphical Programmer
HMI	Human Machine Interface
PAC	Personnel Access Controller
ENTERPRISE SERVER	T.A.C. Graphical User Interface

## 2.02 OPEN, INTEROPERABLE, INTEGRATED ARCHITECTURES

- A. The intent of this specification is to provide a peer-to-peer networked, stand-alone, distributed control system with the capability to integrate LonWorks Technologies using Free Topology Transceivers (FTT-10), and specific conformance to the LONMARK Interoperability Association's v3.1 Physical and logical Layer guidelines in all unitary, terminal unit and other devices or both communication protocols in one interoperable system.
- B. The supplied computer software system shall employ object-oriented technology (OOT) for representation of all data and control devices within the system. In addition, adherence to industry standards including LonMark to assure interoperability between all system components is required. For each LonWorks device that does not have LonMark certification, the device supplier must provide an XIF file for the device.
- C. All components and controllers supplied under this contract shall be true "peer-to-peer" communicating devices. Components or controllers requiring "polling" by a host to pass data shall not be acceptable.
- D. The supplied system must incorporate the ability to access all data using Java enabled browsers without requiring proprietary operator interface and configuration programs. An Open DataBase Connectivity (ODBC) or Structured Query Language (SQL) compliant server database is required for all system database parameter storage. This data shall reside on a supplier-installed server for all database access. Systems requiring proprietary database and user interface programs shall not be acceptable.
- E. A hierarchical topology is required to assure reasonable system response times and to manage the flow and sharing of data without unduly burdening the customer's internal Intranet network. Systems employing a "flat" single tiered architecture shall not be acceptable.
  - 1. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 5 seconds for network connected user interfaces.
  - 2. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 60 seconds for remote or dial-up connected user interfaces.

## 2.03 NETWORKS

- A. The Local Area Network (LAN) shall be residing on the existing SMCCCD Ethernet network supporting Java, XML, HTTP and COBRA IIOP for maximum flexibility for integration of building data with enterprise information systems and providing support for multiple Network Area Controllers (NACs), user workstations and, if specified, a local host computer system.
- B. Access to the system from a remote location shall be via the utilizing an adequate PC with standard web browser and from a local computer system (by owner) via direct connection to the Ethernet LAN or thru VPN.
- C. Local area network minimum physical and media access requirements:
  - 1. Ethernet; IEEE standard 802.3
  - 2. Cable; 10 base-T, UTP-8 wire, category 5
  - 3. Minimum throughput; 10Mbps with ability to increase to 100 Mbps

## 2.04 NETWORK AREA CONTROLLER (NAC)

- A. The Network Area Controller (NAC) shall provide the interface between the LAN or WAN and the field control devices, and provide global supervisory control functions over the control devices connected to the NAC. It shall be capable of executing application control programs to provide:
  - 1. Calendar functions
  - 2. Scheduling
  - 3. Trending
  - 4. Alarm monitoring and routing
  - 5. Time synchronization
  - 6. Integration of LonWorks controller data
  - 7. Network management functions for all LonWorks devices
- B. The NAC shall provide multiple user access to the system and support for ODBC or SQL. An embedded database resident on the NAC must be an ODBC-compliant database or must provide an ODBC data access or must provide an ODBC data access mechanism to read and write data stored within it.



- C. The NAC must provide the following hardware features as a minimum:
1. One Ethernet port –10 / 100 Mbps
  2. Two RS-232 ports
  3. One LonWorks port – 78KB FTT-10A
  4. Battery backup
  5. Flash memory for long term data backup (If battery backup or flash memory is not supplied, the controller must contain a hard disk with at least 1-gigabyte storage capacity)
  6. The NAC must be capable of operation over a temperature range of 0-55°C
  7. The NAC must be capable of withstanding storage temperatures of between 0 and 70°C
  8. The NAC must be capable of operation over a humidity range of 5-95% non-condensing
- D. The NAC must provide all tools for Java enabled Web browser access via the Intranet/Internet. It shall support a minimum of 16 simultaneous users in its minimum configuration.
- E. Event Alarm Notification and Actions
1. The NAC shall provide alarm recognition, storage; routing, management, and analysis to supplement distributed capabilities of equipment or application specific controllers.
  2. The NAC shall be able to route any alarm condition to any defined user location whether connected to a local network or remote via dial-up, telephone connection, or wide-area network.
  3. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including but limited to:
    - a) To alarm
    - b) Return to normal
    - c) To fault
  4. Provide for the creation of an unlimited number of alarm classes for the purpose of routing types and or classes of alarms, i.e.: security, HVAC, Fire, etc.
  5. Provide timed (schedule) routing of alarms by class, object or node.

6. Provide alarm generation from binary object “runtime” and /or event counts for equipment maintenance. The user shall be able to reset runtime or event count values with appropriate password control.
7. Control equipment and network failures shall be treated as alarms and annunciated.
8. The systems shall be capable to annunciate alarms in the following manners:
  - a) Screen message text
  - b) Email of the complete alarm message to multiple recipients. Provide the ability to route and email alarms based on day of the week, time of day and recipient.
  - c) Pagers via paging services that initiate a page on receipt of email message.
  - d) Graphic with flashing alarm object(s)
  - e) Printed message, routed directly to a dedicated alarm printer
  - f) Audio messages
9. The following shall be recorded by the NAC for each alarm (at a minimum):
  - a) Time and date
  - b) Location (building, floor, zone, etc.)
  - c) Equipment (air handler, etc.)
  - d) Acknowledge time, date and user who issued acknowledgement
  - e) Number of occurrences since last acknowledgement
10. Alarm actions may be initiated by user defined programmable objects created for that purpose.
11. Defined users shall be given proper access to acknowledge any alarm, or specific types or classes of alarms defined by the user.
12. A log of alarms shall be maintained by the NAC and/or a server (if configured in the system) and shall be available for review by the user.
13. Provide a “query” feature to allow review of specific alarms by user defined parameters.
14. A separate log for system alerts (controller failures, network failures, etc.) shall provided and available for review by the user.
15. An Error Log to record invalid property changes or commands shall be provided and available for review by the user.

F. Data Collection and Storage

1. The NAC shall be provided with the ability to collect data for any property of any object and store this data for future use.
2. The data collection shall be performed by a log object that shall have, at a minimum, the following configurable properties:
  - a) Designating the log as interval or deviation.
  - b) For interval logs, the object shall be configured for time of day, day of week and the sample collection interval.
  - c) For deviation logs, the object shall be configured for the deviation of a variable to a fixed value. This value, when reached, will initiate logging of the object.
  - d) For all logs, provide the ability to set the maximum number of data stores and to set whether the log will stop collecting when full, or rollover the data on a first-in, first-out basis.
  - e) Each log shall have the ability to have its data cleared on a time-based event or by a user-defined event or action.
3. All log data shall be stored in a relational data base in the NAC and the data shall be accessed from a server (if the system is so configured) or a standard Web Browser.
4. All log data shall be available to the user in the following formats:
  - a) HTML
  - b) XML
  - c) Plain text
  - d) Comma or tab separated values
5. The NAC shall have the ability to archive it's log data via a server on the network. Provide the ability to configure the following archiving properties, at a minimum:
  - a) Archive on time of day
  - b) Archive on user-defined number of data stores in the log (buffer size)
  - c) Archive when log has reached it's user-defined capacity of data stores

- d) Provide ability to clear logs once archived
- 
6. The NAC shall provide and maintain an Audit Log that tracks all activities performed on the NAC. Provide the ability to specify a buffer size for the log and the ability to archive log based on time or when the log has reached it's user-defined buffer size. Provide the ability to archive the log locally (to the NAC), to another NAC on the network, or to a server. For each log entry, provide the following data:
    - a) Time and date
    - b) User ID
    - c) Change or activity: i.e., Change setpoint, add or delete objects, commands, etc.
  7. Data Base back up and storage:
    - a) The NAC shall have the ability to automatically backup its database. The database shall be backed up monthly.
    - b) Copies of the current database and, at the most recently saved database shall be stored in the NAC.
    - c) The NAC database shall be stored, at a minimum, in XML format to allow for user viewing and editing, if desired. Other formats are acceptable as well, as long as XML format is supported.

## 2.05 STANDALONE DIGITAL CONTROLLERS (INVENSYS IA-SERIES)

### General

- A. The SDC controllers shall permit the simultaneous operation of all control, communication facilities management and operator interface software, as programmed by the Contractor or User. Modification of the on-board SDC controller database shall be performed on-line using the built-in interface. Systems that require the SDC to be removed from service while DDC control sequences are modified shall not be acceptable.
- B. SDC controllers shall utilize true floating-point arithmetic capabilities. To accommodate totalization of large totalized values, SDCs with reporting capability shall support the calculation, accumulation and display of values within the range of +/-10 to the 10th power. The SDC shall employ a multi-tasking, multi-user operating system.
- C. All programming defining the functions to be performed by the SDC, including but not limited to application programs and point database within each SDC shall be protected from loss due to power failure for a minimum of six months. Systems not providing non-volatile memory shall provide a system rechargeable battery backup system sufficient to provide protection for the specified 6 month period.
- D. SDC controllers shall be equipped with a minimum of two operator service ports for the connection of serial devices such as the GP, HMI, modems, printers, etc. Connection of a service device, to a service port, shall not cause the SDC controller to lose communications with its peers or other networked device controllers. The SDC shall be able to route alarms, trends, and reports to any serial device connected to the network. This shall also include the auto dialing to remote locations. The SDC shall be capable of dialing out to a minimum of ten remote locations for the annunciation of alarms. Alarms shall include the time, date, and alarm condition, in addition to a user-defined detailed message detailing the condition.
- E. The SDC shall provide Alarming, point trending and Energy report generation capabilities. Alarming points shall be uniquely definable, with multiple alarms assignable to a single point. Such alarms shall be provided with a unique 80-character message. Systems utilizing an alarm messages library, shall describe the size of the library and verify how all alarming within the SDC will be guaranteed unique 80 character messages.
- F. The quantities of trended point values shall be limited only by total controller memory space. If necessary, a SDC may be dedicated fully to a trending task, allowing all controller memory to be available for the trend storage. Each unique trend report shall contain a minimum of 4 different points and a minimum of 128 samples per point.

Trending frequency for each report shall be operator definable from a sample once a second to a sample once every 24 hours. Trend reports shall be internally formatted by the SDC and shall be reportable directly to a serial printer, a VT-100 display terminal, a CCS, CHS or any other device capable of receiving a formatted ASCII data file.

- G. The energy reports shall not be limited in quantities only by available memory within the GDC. Each Energy report shall be fully formatted and reportable to a serial printer, a VT-100 display terminal, a CCS, a CHS or any other device capable of receiving a formatted ASCII data file. As a minimum, each Energy report shall provide a daily report and a monthly report with summary information such as outside air temperature, outside air humidity, total energy consumed and degree-day calculations.
- H. The SDC controller shall provide a built-in operator interface, which consists of an alphanumeric LCD display of 4 lines x 20 characters, and a multi-function keyboard. Devices without such built-in displays shall provide a permanently connected HMI as described elsewhere in this specification, one per SDC.
- I. The SDC shall provide for logical grouping of network variables and allow for viewing and editing of system parameters. Logical grouping menus shall allow for detailed descriptions of system variables of a minimum of 20 characters.
- J. The SDC shall communicate via the BMS Network Interfaces to the enterprise LAN, whether dedicated or common. The SDC shall provide communications connectivity to the LonWorks bus and shall support any LONMARK/LonWorks compliant devices.
- K. The SDC shall provide connectivity to the currently marketed BMS solutions offered by the manufacturer. The SDC shall be interoperable these BMS offerings for scheduling, global data sharing, Energy Demand Limiting, alarming, optimized start/stop, and systems integrations for all other data within the entire BMS. In addition, the SDC shall provide connectivity to existing DDC controllers currently marketed by the manufacturer.
- L. The SDC shall be compliant with the current and previously marketed HMIs of the manufacturer, and shall be capable of full bi-directional communications through the LAN, with previously manufactured SDC controllers sold for the last ten years by the manufacturer.

## 2.6 INTEROPERABLE LONMARK CONTROLLERS (INVENSYS IA-SERIES)

### General

- A. Controls shall be microprocessor based Interoperable Invensys IA Series Controllers (IA), bearing the applicable LONMARK interoperability logo on each product delivered. IAs shall be provided for Unit Ventilators, Fan Coils, Heat Pumps, VAV Terminal Boxes and other applications as shown on the drawings. IAs shall be based on the Echelon Neuron 3150 microprocessor working from software program memory which is physically located in the IA. The application control program shall be resident within the same enclosure as the input/output circuitry, which translates the sensor signals.
- B. To simplify controls and mechanical service troubleshooting, the IA shall be mounted directly in the control compartment of the unitary system. The IA shall be provided with a sheet metal or polymeric enclosure that is constructed of material allowing for the direct mounting within the primary air stream, as defined by UL-465. The direct mounting shall allow all controls maintenance and troubleshooting to be made while at the unitary equipment.
- C. The IAs shall communicate with the SDC at a baud rate of not less than 78.8K baud. The IA shall provide LED indication of communication and controller performance to the technician, without cover removal.
- D. The IAs shall be fully supported and communicate with any and all GUI(s) on the bus.
- E. S-Bus Sensor

The S-Bus Sensor shall connect directly to the IA controller and shall not utilize any of the I/O points of the controller. The S-Bus Sensor shall provide a two-wire connection to the controller that is polarity and wire type insensitive. The S-Bus Sensor shall provide a communications jack for connection to the LON communication trunk to which the IA controller is connected. The S-Bus Sensor, the connected controller, and all other devices on the LON bus shall be accessible by the Graphical Programming tool.

The S-Bus Sensor shall be available in the following variations;

Tamper-resistant (no display)

Tamper-resistant with tenant override

Basic user functions (LCD display and setpoint adjustment and tenant override)

Full user functions (LCD display and network-variable access and tenant override)

ASHRAE 95 compliance (LCD display and sub-base functionality)

The S-Bus Sensor shall be provided in a modular configuration that allows for the rough in of all wiring without the presence of the electronics or esthetic covering. The IA Sensor shall allow for the customization of the color on the esthetic covering as a standard offering. User interface with the IA Sensor shall be provided as a configurable function by the BMS, and shall offer password protection for access to network variable editing. Multiple network variables shall be accessible and editable by the IA Sensor. Icons shall be utilized to represent sensor and controller function status, affording independence from a single language for use interface.

F. IA Controller Functionality

The IA CONTROLLER shall provide a -40 to 140 degree Fahrenheit ambient operating temperature range. The IA CONTROLLER shall be provided in a modular configuration that allows for the rough in of all wiring without the presence of any of the IA Controller electronics. IA Controller devices that require the electronics to be present at the time of wiring, will require an additional controller to be provided for every 10 devices on the drawings, to allow for the preconfiguration and storing for service purposes.

G. All input/output signals shall be directly hardwired to the IA Controller. For all non-VAV terminal applications, a minimum of two input points of the IA Controller shall employ a universal configuration that allows for flexibility in application ranging from dry contact, resistive, to voltage/current sourced inputs. If universal points are not available, a minimum of two input points (each) of the dry contact, resistive and analog voltage/current types must be provided on every controller. The outputs of the IA Controller shall be of the relay and universal analog form. All digital outputs shall be relay type. IA Controller devices utilizing non-relay outputs shall provide an interface relay for all points. All analog outputs shall be programmable for their start points and span to accommodate the control devices. Configuration of all I/O points shall be accomplished without physical hardware jumpers, switches or settings. Troubleshooting of input/output signals shall be easily executed with the Graphical Programming tool (GP) or a volt-ohm meter (VOM). All I/O points shall be utilized by the local IA Controller or shall be available as I/O points for other controllers throughout the network.

H. All IA Controllers shall be fully application programmable and shall at all times maintain their LONMARK certification. Controllers offering application selection only (non-programmable), require a 10% spare point capacity to be provided for all applications. All control sequences within or programmed into the IA Controller shall be stored in non-volatile memory, which is not dependent upon the presence of a battery, to be retained.

I. The IA Controller shall be provided with the ability to interface with the



Graphical Programming tool. The interface port shall be provided at the wall sensor or within the unitary equipment, as specified on the plans. The interface port shall allow the GP to have full functionality as described in GP section of this specification. Through the connected controller all IA Controller devices on the LON bus shall be accessible by the Graphical Programming tool.

- J. Mechanical equipment manufacturers desiring to provide IA Controller type controls as factory mounted equipment, shall provide a separate bid for their products less all controls, actuators, valve assemblies and sensors, which are specified to be provided by the BMS contractor.

## 2.07 SYSTEM PROGRAMMING

- A. The system supplied by the installer must be programmed using “Java” objects. A library of control, application, and graphical objects shall be provided to enable the creation of all applications and user interface screens. Applications are to be created by selecting the desired control objects from the library, dragging or pasting them on the screen, and “wiring” them together using a built in graphical connection tool. Completed applications may be stored in the library for future use. Graphical User screens are created in the same fashion. Data for the user screens is obtained by graphically linking the user screen objects to the application objects to provide “real-time” data updates. Any real-time data value or object property may be connected to display its current value on a user screen. Systems requiring separate software tools or processes to create applications and user interface screens shall not be acceptable.

### B. Programming Methods

1. Provide the capability to copy objects from the supplied libraries, or from a user-defined library to the user’s application. Objects shall be linked by a graphical soft-wiring scheme by dragging a link from one object to another. Object links will support one-to-one, many-to-one, or one-to-many relationships. Linked objects shall maintain their connections to other objects regardless of where they positioned on the page and shall show link identification for links to objects on other pages for easy identification. Links will vary in color depending on the type of link; i.e., internal, external, hardware, etc.
2. Configuration of each object will be done through the object’s property sheet using fill-in the blank fields, list boxes, and selection buttons. Use of custom programming, scripting language, or a manufacturer-specific procedural language for configuration will not be accepted.
3. The software shall provide the ability to view the logic in a monitor mode. When on-line, the monitor mode will provide the ability to view the logic

in real time for easy diagnosis of the logic execution. When off-line, the monitor mode will allow the user to set values to inputs and monitor the logic for diagnosing execution before it is applied to the system.

4. All programming shall be done in real-time. Uploading, editing, and downloading of database objects shall not be allowed.
5. The system shall support object duplication within a customer's database. An application, once configured, can be copied and pasted for easy re-use and duplication. All links, other than to the hardware, shall be maintained during duplication.

2.08 GRAPHICAL USER INTERFACE SOFTWARE (Add to existing ENTERPRISE SERVER System)

- A. Operating System: The GUI shall run on Microsoft Windows 2000 or later.
- B. The GUI shall employ browser-like functionality for ease of navigation. It shall include a tree view (similar to Windows Explorer) for quick viewing of, and access to, the hierarchical structure of the database. In addition, menu-pull downs, and toolbars shall employ buttons, commands and navigation to permit the operator to perform tasks with a minimum knowledge of the HVAC Control System and basic computing skills. These shall include, but are not limited to, forward/backward buttons, home button, and a context sensitive locator line (similar to a URL line), that displays the location and the selected object identification.
- C. Real-Time Displays. The GUI, shall at a minimum, support the following graphical features and functions:
  - 1. Graphic screens shall be developed using any drawing package capable of generating a GIF, BMP, or JPG file format. Use of proprietary graphic file formats shall not be acceptable. In addition to, or in lieu of a graphic background, the GUI shall support the use of scanned pictures.
  - 2. Graphic screens shall have the capability to contain objects for text, real-time values, animation, color spectrum objects, logs, graphs, HTML or XML document links, schedule objects, hyperlinks to other URL's, and links to other graphic screens.
  - 3. Graphics shall support layering and each graphic object shall be configurable for assignment to a layer. A minimum of six layers shall be supported.
  - 4. Modifying common application objects, such as schedules, calendars, and set points shall be accomplished in a graphical manner.
  - 5. Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.
  - 6. Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.
  - 7. Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.

8. Adjustments to analog objects, such as set points, shall be done by right-clicking the selected object and using a graphical slider to adjust the value. No entry of text shall be required.
- D. System Configuration. At a minimum, the GUI shall permit the operator to perform the following tasks, with proper password access:
1. Create, delete or modify control strategies.
  2. Add/delete objects to the system.
  3. Tune control loops through the adjustment of control loop parameters.
  4. Enable or disable control strategies.
  5. Generate hard copy records or control strategies on a printer.
  6. Select points to be alarmable and define the alarm state.
  7. Select points to be trended over a period of time and initiate the recording of values automatically.
- E. On-Line Help. Provide a context sensitive, on-line help system to assist the operator in operation and editing of the system. On-line help shall be available for all applications and shall provide the relevant data for that particular screen. Additional help information shall be available through the use of hypertext. All system documentation and help files shall be in HTML format.
- F. Security. Each operator shall be required to log on to that system with a user name and password in order to view, edit, add, or delete data. System security shall be selectable for each operator. The system administrator shall have the ability to set passwords and security levels for all other operators. Each operator password shall be able to restrict the operators' access for viewing and/or changing each system application, full screen editor, and object. Each operator shall automatically be logged off of the system if no keyboard or mouse activity is detected. This auto log-off time shall be set per operator password. All system security data shall be stored in an encrypted format.
- G. System Diagnostics. The system shall automatically monitor the operation of all workstations, printers, modems, network connections, building management panels, and controllers. The failure of any device shall be annunciated to the operator.

H. Alarm Console

1. The system will be provided with a dedicated alarm window or console. This window will notify the operator of an alarm condition, and allow the operator to view details of the alarm and acknowledge the alarm. The use of the Alarm Console can be enabled or disabled by the system administrator.
2. When the Alarm Console is enabled, a separate alarm notification window will supercede all other windows on the desktop and shall not be capable of being minimized or closed by the operator. This window will notify the operator of new alarms and un-acknowledged alarms. Alarm notification windows or banners that can be minimized or closed by the operator shall not be acceptable.

## 2.09 WEB BROWSER CLIENTS

- A. The system shall be capable of supporting an unlimited number of clients using a standard Web browser such as Internet Explorer™ or Netscape Navigator™. Systems requiring additional software (to enable a standard Web browser) to be resident on the client machine, or manufacture-specific browsers shall not be acceptable.
- B. The Web browser software shall run on any operating system and system configuration that is supported by the Web browser. Systems that require specific machine requirements in terms of processor speed, memory, etc., in order to allow the Web browser to function with the BMS, shall not be acceptable.
- C. The Web browser shall provide the same view of the system, in terms of graphics, schedules, calendars, logs, etc., and provide the same interface methodology as is provided by the Graphical User Interface. Systems that require different views or that require different means of interacting with objects such as schedules, or logs, shall not be permitted.
- D. The Web browser client shall support at a minimum, the following functions:
  - 1. User log-on identification and password shall be required. If an unauthorized user attempts access, a blank web page shall be displayed. Security using Java authentication and encryption techniques to prevent unauthorized access shall be implemented.
  - 2. Graphical screens developed for the GUI shall be the same screens used for the Web browser client. Any animated graphical objects supported by the GUI shall be supported by the Web browser interface.
  - 3. HTML programming shall not be required to display system graphics or data on a Web page. HTML editing of the Web page shall be allowed if the user desires a specific look or format.
  - 4. Storage of the graphical screens shall be in the Network Area Controller (NAC), without requiring any graphics to be stored on the client machine. Systems that require graphics storage on each client are not acceptable.
  - 5. Real-time values displayed on a Web page shall update automatically without requiring a manual “refresh” of the Web page.
  - 6. User’s shall have administrator-defined access privileges. Depending on the access privileges assigned, the user shall be able to perform the following:

- a) Modify common application objects, such as schedules, calendars, and set points in a graphical manner.
  - b) Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.
  - c) Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.
  - d) Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.
  - e) View logs and charts
  - f) View and acknowledge alarms
7. The system shall provide the capability to specify a user's (as determined by the log-on user identification) home page. Provide the ability to limit a specific user to just their defined home page. From the home page, links to other views, or pages in the system shall be possible, if allowed by the system administrator.
8. Graphic screens on the Web Browser client shall support hypertext links to other locations on the Internet or on Intranet sites, by specifying the Uniform Resource Locator (URL) for the desired link.

## 2.10 DDE DEVICE INTEGRATION

- A. The NAC shall support the integration of device data via Dynamic Data Exchange (DDE), over the Ethernet Network. The NAC shall act as a DDE client to another software application that functions as a DDE server.
- B. Provide the required objects in the library, included with the Graphical User Interface programming software, to support the integration of these devices into the BMS. Objects provided shall include at a minimum:
  1. DDE Generic AI Object
  2. DDE Generic AO Object
  3. DDE Generic BO Object
  4. DDE Generic BI Object

## 2.11 LonWorks NETWORK MANAGEMENT

- A. The Graphical User Interface software (GUI) shall provide a complete set of integrated LonWorks network management tools for working with LonWorks networks. These tools shall manage a database for all LonWorks devices by type and revision, and shall provide a software mechanism for identifying each device on the network. These tools shall also be capable of defining network data connections between LonWorks devices, known as “binding”. Systems requiring the use of third party LonWorks network management tools shall not be accepted.
- B. Network management shall include the following services: device identification, device installation, device configuration, device diagnostics, device maintenance and network variable binding.
- C. The Network configuration tool shall also provide diagnostics to identify devices on the network, to reset devices, and to view health and status counters within devices.
- D. These tools shall provide the ability to “learn” an existing LonWorks network, regardless of what network management tool(s) were used to install the existing network, so that existing LonWorks devices and newly added devices are part of a single network management database.
- E. The network management database shall be resident in the Network Area Controller (NAC), ensuring that anyone with proper authorization has access to the network management database at all times. Systems employing network management databases that are not resident, at all times, within the control system shall not be accepted.

## 2.12 GRAPHICAL USER INTERFACE COMPUTER (provided by owner if required)

- A. The desktop computer shall be an Intel Pentium based computer (minimum processing speed of 400 Mhz with 256 MB RAM and a 10-gigabyte minimum hard drive). It shall include a 32X CD-ROM drive, 3.5” floppy drive, a 100 MB Zip drive, 2-parallel ports, 2-asynchronous serial ports and 2-USB ports. A minimum 17”, 28-dot pitch SVGA color monitor with a minimum 80 Hz refresh rate shall also be included.
- B. A system printer shall be provided. Printer shall be laser type with a minimum 600 x 600-dpi resolution and rated for 8-ppm print speed minimum.



## 2.13 OTHER CONTROL SYSTEM HARDWARE

- A. Wall Mount Room Thermostats: Each room thermostat shall provide temperature indication to the digital controller, provide the capability for a software-limited set point adjustment and operation override capability. An integral LCD shall annunciate current room temperature and set point as well as override status indication. In addition, the thermostat shall include a port for connection of the portable operator's terminal described elsewhere in this specification.
- B. Power Monitoring Interface: The Power Measurement Interface (PMI) device shall include the appropriate current and potential (voltage) transformers. The PMI shall be certified under UL-3111. The PMI shall perform continuous true RMS measurement based on 32 samples-per-cycle sampling on all voltage and current signals. The PMI shall provide outputs to the BMS based on the measurement and calculation of the following parameters: (a) current for each phase and average of all three phases, (b) kW for each phase and total of all three phases, (c) power factor for each phase and all three phases, (d) percent voltage unbalance and (e) percent current unbalance. These output values shall be hard-wired inputs to the BMS or shall be communicated to the BMS over the open-protocol LAN.
- C. Wall Mount Room Thermostats: Each room thermostat shall provide temperature indication to the digital controller, provide the capability for a software-limited set point adjustment and operation override capability. An integral LCD shall annunciate current room temperature and set point as well as override status indication. In addition, the thermostat shall include a port for connection of the portable operator's terminal described elsewhere in this specification.
- D. Temperature Control Panels: Furnish temperature control panels of code gauge steel with locking doors for mounting all devices as shown. Control panels shall meet all requirements of Title 24, California Administrative Code. All electrical devices within a control panel shall be factory wired. All external wiring shall be connected to terminal strips mounted within the panel. Provide engraved phenolic nameplates identifying all devices mounted on the face of control panels. A complete set of 'as-built' control drawings (relating to the controls within that panel) shall be furnished within each control panel.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. All work described in this section shall be installed, wired, circuit tested and calibrated by factory certified technicians qualified for this work and in the regular employment of the temperature control system manufacturer or its exclusive factory authorized installing contracting field office (representative). The installing office shall have a minimum of five years of installation experience with the manufacturer and shall provide documentation in submittal package verifying longevity of the installing company's relationship with the manufacturer. Supervision, calibration and checkout of the system shall be by the employees of the local exclusive factory authorized temperature control contracting field office (branch or representative).
- B. Install system and materials in accordance with manufacturer's instructions.
- C. Line voltage electrical connections to control equipment shown specified or shown on the control diagrams shall be furnished and installed by Div. 16
- D. Equipment furnished by the HVAC Contractor that is normally wired before installation shall be furnished completely wired. Control wiring normally performed in the field will be furnished and installed by the Temperature Control sub-contractor.
- E. All control devices mounted on the face of control panels shall be clearly identified as to function and system served with permanently engraved phenolic labels.

### 3.02 CONTROL SYSTEM WIRING

- A. All electrical control wiring and low voltage power wiring to the control panels shall be the responsibility of the BMS contractor. All 120 V power for control panels by Div.16
- B. All wiring shall be in accordance with Division 16, the National Electrical Code and any applicable local codes. All BMS wiring shall be installed in the conduit types specified in the Project Electrical Specifications (Division 16) unless otherwise allowed by the National Electrical Code or applicable local codes. Where BMS plenum rated cable wiring is allowed it shall be run parallel to or at right angles to the structure, properly supported and installed in a neat and workmanlike manner.
- C. All exposed wiring shall be routed within surface metal raceway painted to match adjacent surfaces and routed in a neat, unobtrusive manner, parallel to surfaces. The routing may often take a non-direct route to minimize its appearance and as such Contractor shall assume extra material and labor to allow for approach.

### 3.03 WARRANTY

- A. Equipment, materials and workmanship incorporated into the work shall be warranted for a period of one year from the time of system acceptance.
- B. Within this period, upon notice by the Owner, any defects in the BMS due to faulty materials, methods of installation or workmanship shall be promptly (within 48 hours after receipt of notice) repaired or replaced by the Temperature Control sub-contractor at no expense to the Owner

### 3.04 WARRANTY ACCESS

- A. The Owner shall grant to the Temperature Control sub-contractor, reasonable access to the BMS during the warranty period. The owner shall provide VPN access at no cost to the contractor, for remote communication to the BMS during this period.

### 3.05 ACCEPTANCE TESTING

- A. Upon completion of the installation, the Temperature Control sub-contractor shall load all system software and start-up the system. The Temperature Control sub-contractor shall perform all necessary calibration, testing and de-bugging and perform all required operational checks to insure that the system is functioning in full accordance with these specifications.
- B. Graphical User Interface software documentation shall be provided in HTML document format with context-sensitive hyperlinks is an integral part of the graphical user interface and does not require separate hard-copy manuals.
- C. The Temperature Control sub-contractor shall perform tests to verify proper performance of components, routines, and points. Repeat tests until proper performance results. This testing shall include a point-by-point log to validate 100% of the input and output points of the DDC system operation.
- D. Upon completion of the performance tests described above, repeat these tests, point by point as described in the validation log above in presence of Owner's Representative, as required. Properly schedule these tests so testing is complete at a time directed by the Owner's Representative. Do not delay tests so as to prevent delay of occupancy permits or building occupancy.

- E. System Acceptance: Satisfactory completion is when the Temperature Control sub-contractor has performed successfully all the required testing to show performance compliance with the requirements of the Contract Documents to the satisfaction of the Owner's Representative. System acceptance shall be contingent upon completion and review of all corrected deficiencies.

### 3.06 OPERATOR INSTRUCTION, TRAINING

- A. During system check-out and testing and at such time acceptable performance of the BMS hardware and software has been established the Temperature Control sub-contractor shall provide on-site operator instruction to the owner's operating personnel. Operator instruction shall be done during normal working hours and shall be performed by a competent representative familiar with the system hardware, software and accessories.
- B. The Temperature Control sub-contractor shall provide 16 hours of instruction to the owner's designated personnel on the operation of the BMS system and describe its intended use with respect to the programmed functions specified. Operator orientation of the BMS system shall include, but not be limited to; the overall operation program, equipment functions (both individually and as part of the total integrated system), commands, systems generation, advisories, and appropriate operator intervention required in responding to the System's operation.
- C. The training shall be in two sessions as follows:
  - 1. Initial Training: One day session (8 hours) after system is started up and at least one week before first acceptance test. Manual shall have been submitted at least two weeks prior to training so that the owners' personnel can start to familiarize themselves with the system before classroom instruction begins.
  - 2. First Follow-Up Training: One days (8 hours) approximately two weeks after initial training, and before Formal Acceptance. These sessions will deal with more advanced topics and answer questions.

END OF SECTION

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**SECTION 26 00 00**

**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 furnishing and installing all materials and equipment and provides all labor to complete the work shown on the drawings and/or specified for a complete installation. Items not specifically mentioned, but reasonably inferred for a complete installation, including all accessories required for testing are included. It is the intent of the drawings and specifications that all systems are complete, and ready for operation.

**1.3 CONDITIONS & REQUIREMENTS:**

- A. Refer to the General Conditions and Supplementary General Conditions.
- B. Provisions of this Section apply to all Sections of Division 26.

**1.4 DEFINITIONS (APPLICABLE TO DRAWINGS AND SPECIFICATIONS):**

- A. Above Grade: Not buried in ground and not embedded in concrete slab on grade.
- B. Below Grade: Buried in ground or embedded in concrete slab on grade.
- C. Concealed: Inside building above grade and located within walls, furred spaces, crawl spaces, attics, above suspended ceilings, etc. In general, any item not visible or directly accessible.
- D. Connect (verb): Make electrical connections including conduit, wire and other accessories.
- E. Electrolier: Complete assembly of luminaire and mounting pole or arm.
- F. Exposed: Either visible or subject to mechanical or weather damage, indoors or outdoors, including areas such as electrical mechanical and storage rooms. In general any item that is directly accessible without removing panels, walls, ceilings, or other parts of structure.
- G. Furnish: Supply and deliver a specified item.
- H. Install: Place, secure and connect as required to make fully operational.
- I. Luminaire: Complete lighting unit, not including the mounting pole or arm.
- J. Project Manager: Representative of the Owner with overall responsibility for the project.
- K. Provide: Furnish and install as defined above; perform work.

- L. Underground: Buried in ground, including under building slabs.
- M. Use (verb): Furnish and install as defined above.
- N. Wiring: Electrical raceway, conductors and connections.

**1.5 SCOPE OF WORK:**

- A. Furnish and install all materials and equipment and provide all labor to complete the work shown on the drawings and/or specified for a complete installation. Items not specifically mentioned, but reasonably inferred for a complete installation, including all accessories required for testing are included. It is the intent of the drawings and specifications that all systems are complete, and ready for operation.

**1.6 RELATED WORK:**

- A. Trenching, Backfilling, and Compacting: See Civil Specifications

**1.7 CODE COMPLIANCE:**

- A. All work and materials shall comply with the latest rules, codes and regulations, including, but not limited to, the following:
  - 1. Occupational Safety and Health Act Standards (OSHA).
  - 2. California Electrical Code (CEC), 2007.
  - 3. California Building Code (CBC), 2007
  - 4. Applicable Federal, State and local laws and regulations.
  - 5. Americans with Disabilities Act (ADA) for mounting heights and alarm equipment.
- B. Code compliance is mandatory. Nothing in these Drawings and Specifications implies acceptance of work not conforming to these codes. Where work is shown to exceed minimum code requirements, comply with drawings and specifications.
- C. Do not conceal any work until after inspection and approval by proper authorities. If work is concealed without inspection and approval, open and restore the concealed areas and make the required modifications without cost to the Owner.

**1.8 PERMITS AND FEES:**

- A. Arrange for required inspections and pay all permit and inspection fees except as directed by the Architect. Arrange and pay for required 3<sup>rd</sup> party testing as directed.

**1.9 CONDITIONS AT SITE:**

- A. Visit and become familiar with the site prior to submission of bid. No allowance will be made for conditions that could reasonably be anticipated.
- B. Arrange for location of public utility and Owner's existing services prior to excavation. Promptly repair lines that are damaged as a result of this work at no expense to and the complete satisfaction of the Owner.

**1.10 DRAWINGS AND SPECIFICATIONS:**



- A. All drawings and all Divisions of these specifications shall be considered as a whole and all electrical work is included under this Division.
- B. Drawings are diagrammatic and indicate the general arrangement of equipment and wiring. Most direct routing of conduits and wiring is not assured. Exact requirements shall be governed by architectural, structural and mechanical conditions of the job. Consult all other drawings in preparation of the bid. Include extra lengths of wiring or addition of pull or junction boxes, etc., required by field conditions bid. Check all information and report any apparent discrepancies before submitting bid.
- C. Right is reserved to make change up to ten feet in location of any outlet or equipment prior to roughing-in without increasing contract cost.

**1.11 SAFETY:**

- A. The Contractor is solely and completely responsible for conditions of the job site, including safety of all persons and property during performance of the work. This requirement applies continuously and is not limited to normal working hours.
- B. No act, service, drawing review, or construction review is intended to include review of the adequacy of the Contractor's safety measures, in, on, or near the construction site.

**1.12 HAZARDOUS MATERIALS:**

- A. Handling and abatement of hazardous or toxic materials, including asbestos and polychlorinated biphenyls (PCBs), is not included in the electrical Scope of Work.
- B. If hazardous materials are discovered or suspected, protect the equipment from damage and report the conditions to the Project Manager. Some equipment, such as older circuit breakers may have components of hazardous materials such as asbestos.

**1.13 CHANGES BY CONTRACTOR:**

- A. Submit scaled drawing(s) prior to installation of any proposed modifications to equipment layouts, device locations, conduit routing, or conductor groupings. Any approved modifications shall be issued in accordance with the procedures described in Document 00 71 00 – General Conditions.

**1.14 RECORD DRAWINGS:**

- A. Maintain a separate set of electrical drawings at the job site at all times to be used as record drawings. Keep this set current with all changes and additions and deliver to the Project Manager at the completion of the job. Keep the record drawings clean.

**1.15 GUARANTEE:**

- A. Guarantee workmanship and materials (except lighting ballasts) for one year after date of Substantial Completion. Guarantee ballasts for two years. Make repairs and replace defective materials at no charge to Owner.
- B. Furnish manufacturers' warranties to the Project Manager

**PART 2 - PRODUCTS**

**2.1 MATERIAL APPROVAL:**

- A. The design, manufacture and testing of electrical equipment and materials shall conform to or exceed latest applicable NEMA, IEEE and ANSI standards.
- B. All materials shall be new and listed and labeled by Underwriters Laboratories (UL).
- C. Materials that are not covered by UL testing standards shall be tested and accepted by an independent testing laboratory or a governmental agency, which laboratory shall be acceptable to the Project Manager and code enforcing authority.

**2.2 SHOP DRAWINGS AND MATERIALS LIST:**

- A. Submit shop drawings and product descriptive literature as specified for review:
  - 1. Conduit
  - 2. Wire and Cable
  - 3. Splicing Materials
  - 4. Transformers
  - 5. Panelboards
  - 6. Circuit Breakers, Low and Medium Voltage
  - 7. Electrical Enclosures and Controls
  - 8. Underground pullboxes and lids
  - 9. Padmount Switches
  - 10. Switchgear and Switchboard Assemblies
- B. The material list shall not include items where no specific manufacturer is shown in the Specifications. Where manufacturers are shown, the material list shall include only one manufacturer for each type of equipment or system.
- C. Review of submittals is for general conformance to design concept and general compliance with Contract Documents. Review comments do not relieve the Contractor from responsibility for compliance with Contract Documents.
- D. Mark all proposed deviations from specifications prominently in the submittals.
- E. Deviations not so marked may be disallowed before or after installation of equipment.
- F. Confirm confirming and correlate all quantities and dimensions, select fabrication processes and techniques of construction. Where dimensions of proposed equipment differ significantly from that shown on contract documents, submit scaled drawings showing proposed layout of equipment with shop drawing submittal.

**PART 3 - EXECUTION**

**3.1 WORKMANSHIP AND CONTRACTOR'S QUALIFICATIONS:**

- A. Only quality workmanship will be accepted. Haphazard or poor installation practice will be cause for rejection of work.
- B. Provide a foreman on the site and in charge of this work at all times. Provide appropriate supervision at each location if there are more than one.

**3.2 COORDINATION:**

- A. Coordinate work with other trades to avoid conflict and to provide correct rough-in and connection for equipment furnished under trades that require electrical connections. Inform Contractors of other trades of the required access to and clearances around electrical equipment to maintain serviceability and code compliance.
- B. Verify equipment dimensions and requirements with provisions specified under this Section. Check actual job conditions before fabricating work. Report necessary changes in time to prevent needless work. Changes or additions that are made without written authorization and an agreed price are at Contractor's risk and expense.

**3.3 MANUFACTURERS' INSTRUCTIONS:**

- A. Where the Specifications call for an installation to be made in accordance with manufacturers' recommendations, keep a copy of such recommendations on the site and available to the Project Manager.
- B. Follow manufacturers' instructions where they cover points not specifically indicated on drawings and specifications. If they are in conflict with the drawings and specifications obtain clarification from the Project Manager before starting work.

**3.4 QUALITY ASSURANCE:**

- A. Provide a meaningful Quality Assurance program. The Specifications include minimum acceptable requirements; take other Quality Assurance measures to obtain a complete operating facility within the scope of this project and at the appropriate time according to Schedule
- B. Insure that all workmanship, all materials employed, all required equipment, and the manner and method of installation conforms to accepted construction and engineering practices. Verify that each piece of equipment is in working condition and satisfactorily performs its intended function. No equipment shall be energized until testing is satisfactorily completed.
- C. 3<sup>rd</sup> party testing is included in the scope of Quality Assurance

**3.5 CUTTING AND PATCHING:**

- A. All cutting and patching required for work of this Division is included. Coordinate with other trades and bear the responsibility for and the added expense of adjusting for improper holes, supports, etc.
- B. Obtain permission from Owner before performing any work that may affect the strength of a structural member.
- C. Make repairs and patches to match the quality and appearance of the original work.

**3.6 SEISMIC RESTRAINT:**

- A. Anchor all electrical equipment to prevent excessive motion during an earthquake. Provide anchors that meet the requirements of the California Building Code (CBC) and local authorities.
- B. Provide seismic calculations by a Registered Structural Engineer to verify supports for major equipment and when required by local authorities.

- C. Provide vibration isolators with seismic restraints at transformers, generators, and other vibrating equipment except where isolators are provided by the manufacturer

**3.7 ACCEPTANCE DEMONSTRATION:**

- A. Upon completion of the work, at a time to be designated by the Project Manager, demonstrate for the Owner the operation of the installation, including any and all special items installed by him or installed under his supervision. Allow eight hours of demonstration time.
- B. This demonstration by the Electrical Contractor is in addition to the "Start-Up" service to be provided by the manufacturers specified in the specific sections of Division 26.

**END OF SECTION**

## SECTION 26 04 63

### DRY TYPE TRANSFORMERS

#### PART 1 - GENERAL

##### 1.1 WORK INCLUDED

This section includes enclosed dry type distribution transformers rated 600 volts and less, sizes up to 500 kVA.

- A. Dry type Two-Winding transformers.
- B. Dry type, K-rated transformers.

##### 1.2 REFERENCES

- A. NEMA ST 1 - Specialty Transformers (Except General Purpose Type)
- B. NEMA ST 20 - Dry Type Transformers for General Applications
- C. IEEE C57.12.01 - General Requirements for Dry-Type Distribution and Power Transformers.
- D. UL 1561 - Dry Type General Purpose and Power Transformers
- E. NEMA TP 1 – Guide for Determining Energy Efficiency for Distribution Transformers
- F. NEMA TP 2 – Standard Test Method for Measuring the Energy Consumption for Distribution Transformers

##### 1.3 SUBMITTALS

- A. Provide submittals in accordance with and in addition to Section 16010, Basic Electrical Requirements, and Division 1 for submittal requirement.
- B. Submit manufacturer's data on dry type transformers, vibration isolators and accessories.
- C. Include outline and support point dimensions of enclosures and accessories; unit weight; voltage; kVA; impedance ratings and characteristics; loss data; efficiency at 25, 50, 75 and 100 percent rated load; sound level; tap configurations; insulation system type, and rated temperature rise.

##### 1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Store transformers in a clean and dry space and protected from weather in accordance with manufacturer's instructions. Cover ventilating openings to keep out dust.
- B. Transformer shall not be used as work tables, scaffolds or ladders.
- C. Handle transformers carefully to avoid damage to material components, enclosure and finish. Use only lifting eyes and brackets provided for that purpose. Damaged transformers shall be rejected and not be installed on project.

#### PART 2 - PRODUCTS

##### 2.1 MATERIALS AND EQUIPMENT

- A. Transformers shall be of dry type complying with the design function requirements of the project. Design characteristics shall be as noted in manufacturer's submittal data.
- B. Furnish copper windings, continuous without splice.
- C. All transformers shall be designed, manufactured, and tested in accordance with all the latest applicable ANSI, NEMA, IEEE and UL standards, and shall be UL listed and bear the UL label.
- D. The equipment and major components shall be certified to the seismic requirements of CBC 2007, Importance Factor: 1.5

**2.2 DRY TYPE TWO-WINDING TRANSFORMERS**

- A. Acceptable manufacturers
  - 1. Square D
  - 2. Eaton / Cutler-Hammer
  - 3. General Electric Company
- B. Dry type transformers shall be NEMA ST 20; factory-assembled, air cooled dry type transformers; ratings as shown on the Drawings.
- C. Insulation system and average winding temperature rise (in a 40 degree C maximum ambient) for rated kVA as follows:

kVA Rating	Insulation Class (degree C)	Temperature Rise (degree C)
1-15 kVA	185	115
25-500 kVA	220	115

- D. The maximum temperature of the top of the enclosure shall not exceed 50 degrees C rise above a 40 degree ambient.
- E. Winding Taps, Transformers: Two 2.5 percent above rated voltage and two 2.5 percent below rated voltage, full capacity taps on primary.
- F. Sound Levels: Maximum sound levels are as follows:

kVA Rating	Sound Level
0-9	40 db
10-50	45 db
51-150	50 db
151-300	55 db
301-500	60 db

- G. Basic impulse level shall be 10 KV.
- H. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.
- I. Transformers 75 kVA and less shall be suitable for wall, floor, or trapeze mounting; transformers larger than 75 kVA shall be floor mounted.
- J. Enclosure shall be NEMA Type 2 or as shown on the Drawings. Provide lifting eyes or brackets.
- K. Nameplate on transformer shall include transformer connection data, kVA ratings, impedance, and overload capacity based on rated allowable winding temperature rise. Identify primary and secondary voltages.
- L. Isolate core and coil from enclosure using vibration absorbing mounts.
- M. Provide identification nameplate in accordance with Section 16195 Electrical Identification.

**2.3 DRY TYPE, K-RATED TRANSFORMERS**

- A. K-rated transformers shall be NEMA ST 20; factory-assembled, air cooled dry type transformers meeting all the requirements as specified under paragraphs 2.2 and 2.4 of this Section; ratings as shown on the Drawings.
- B. Impedance range shall be 3 percent to 5 percent with a 2 percent minimum reactance in order to reduce neutral current when supplying loads with large amount of third harmonic current.
- C. Transformers shall be UL listed and labeled for K-13; ratings as shown on the Drawings.
- D. Three-phase transformer secondary neutral terminal shall be sized for 200 percent of the rated secondary phase current.

**PART 3 - EXECUTION**

**3.1 INSPECTION**

- A. Installer shall examine the areas and conditions under which dry type transformers are to be installed and notify the contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

**3.2 INSTALLATION**

- A. Install dry type transformers as indicated, in accordance with the applicable requirements of the NEC and the National Electrical Contractors Association's "Standard of Installation".
- B. Check for damage and tight connections prior to energizing transformer.
- C. Measure primary and secondary voltages and make appropriate tap adjustments.
- D. Set transformer plumb and level.
- E. Use flexible liquid-tight conduit, 2 ft. minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.
- F. Mount transformers on vibration isolating pads suitable for isolating the transformer noise from the building structure except where internal isolation performs the same function
  - 1. For floor or roof transformer installations, use one pad type Korfund Elasto-Grip, waffle, or equal, at each corner of the transformer, sized for load of 50 lbs./sq. in.
  - 2. For wall hung transformer installations, use spring type Korfund Series P, or equal. Provide sound pads at each corner of the transformer, sized for 1/2 inch deflection.
- G. Avoid mounting transformers in areas where tend to amplify noises, such as stairways, hall areas, and corners near ceilings. Avoid where possible, nearby reflecting object or enclosure that might resonate or echo.
- H. Ground transformers in accordance Drawings and CEC requirements.

**END OF SECTION**

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**SECTION 26 05 00**

**ELECTRICAL GENERAL PROVISIONS**

**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. Work included in this Section are conduits, wires, and other miscellaneous materials not specifically mentioned in other Sections of Division 26, but necessary or required for equipment or system operation or function, and the labor to install them.

**1.3 CONDITIONS & REQUIREMENTS:**

- A. Refer to the General Conditions, Supplementary General Conditions, and Division I General Requirements.

**1.4 INCORPORATED DOCUMENTS**

- A. Related work included in other Sections: All other Sections of Division 26.
- B. Section 26 0000 "Electrical Systems" applies to this Section.

**1.5 SUBMITTALS:**

- A. See Section 26 0000 "Electrical Systems."
- B. Manufacturer's descriptive literature and/or sample if requested by the Project Manager

**PART 2 - PRODUCTS**

**2.1 CONDUITS AND OTHER RACEWAYS:**

- A. Rigid Steel (RS): Hot dipped galvanized.
- B. Intermediate Metal Conduit (IMC): Hot-dipped galvanized.
- C. Electrical Metallic Tubing (EMT): Electro-galvanized steel.
- D. Plastic: Schedule 40PVC, approved for use as non-metallic raceway for 90 degree C conductors. For 4" conduit use 60" radius bends except 48" radius is allowed at risers. For 5" conduit, use 60" radius bends.

- E. Wireway: Code gauge steel, with knockouts and hinged cover. Corrosion resistant gray baked enamel finish.
- F. Provide fittings and accessories approved for the purpose and equal in all respects to the conduit or raceway. EMT connectors and couplings shall be steel set-screw type indoors and steel compression type in wet locations or outdoors.

**2.2 WIRES AND CABLES:**

- A. For power and lighting systems 600V or less: Conductor: THWN/THHN insulated stranded copper, all sizes.
- B. Medium Voltage Power Cable: See Section 26 0513
- C. For signal and communications circuits: Special cables shall be as specified on the Drawings.
  - 1. Conductors for general use: stranded copper, #16 AWG minimum, with THHN/THWN insulation.
  - 2. Conductors for fire alarm systems: solid copper, #16 AWG minimum, with THHN/THWN insulation, 600 volt. Use special cables as shown on the Drawings.

**2.3 OUTLET BOXES, JUNCTION AND PULL BOXES:**

- A. Outlet boxes: Hot-dipped galvanized of required size, 4" square, minimum, for flush mounted devices and lighting fixtures. Cast steel type (FD or equal) with gasketed covers for outdoor or wet locations, cast aluminum is not acceptable.
- B. Junction and pull boxes: Use outlet boxes with appropriate covers as junction boxes wherever possible. Larger junction and pull boxes shall be fabricated from sheet steel, sized according to code, with screw-on covers, finished gray baked enamel.

**2.4 CONDUIT HANGERS:**

- A. For individual conduit runs not directly fastened to the structure, use rod hangers manufactured by Caddy, Unistrut or Power-strut.
- B. For multiple conduit runs, use Unistrut or Powerstrut trapeze type conduit support designed for maximum deflection not greater than 1/8".

**2.5 WIRE CONNECTORS:**

- A. For wires size #8 AWG and smaller, dry locations: Use insulated pressure type (with live spring) rated 105 Degrees C, 600V, for building wiring and 1000V in signs or fixtures. Scotchlok or Ideal.
- B. For wires size #8 AWG and smaller, wet locations including in-ground splice boxes: Use insulated pressure type (with live spring) rated 105 Degrees C, 600V fully encased in epoxy compound or use approved manufactured outdoor splicing kits.
- C. For wires size #6 AWG and larger: T&B or equivalent compression type with 3M #33+ or Plymouth "Slipknot Grey" tape insulation or approved manufactured insulating sleeves. Use approved waterproofing materials for wet locations.

**2.6 TERMINAL CABINETS:**

- A. Fabricate from code gauge steel with flush latch and concealed hinge. Minimum size shall be 20"W X 24"H X 4"D. Finish shall be ANSI 61 light gray enamel.
- B. Provide inside terminal cabinet " thick plywood backboard and terminal strips, one terminal point for each wire within the terminal cabinet.

**2.7 SAFETY DISCONNECT SWITCHES:**

- A. Heavy duty type, 600V, horsepower rated for motors, standard enclosure indoors and weather tight outdoors; fused or non-fused as required. General Electric, Siemens, Square D, or Westinghouse.

**2.8 EQUIPMENT MOUNTING AND SUPPORT HARDWARE:**

- A. Use galvanized steel channels, bolts, washers, etc., for mounting or support of electrical equipment. Use stainless steel hardware in corrosive environments.

**2.9 SUBSURFACE VAULTS AND PULLBOXES:**

- A. Pre-cast concrete type of the size indicated. Where a specific vault is shown, do not substitute without authorization from the Engineer. Provide Heavy Full Traffic bolt-down covers as shown. (H-20 rating may not be sufficient). Provide precast extensions as shown. Provide concrete bottoms and sumps with crushed rock below. Break out sump opening to allow vault to drain. Leave vaults and pullboxes clean with all debris removed and with all cables supported on non-metallic cable supports as shown on the Drawings. Stub conduits stubs for future use 5' out
- B. All vault components are included: Provide lids, covers, cable pulling eyes, cast in strut and all appearances as shown on the Drawings.
- C. Make penetrations by core drilling except where cast-in duct terminations are provided. Seal all penetrations with approved sealant or mechanical seals as shown or as specified in the Civil Section of the Specifications

**PART 3 - EXECUTION**

**3.1 GENERAL:**

- A. Electrical system layouts indicated on the drawings are generally diagrammatic, but shall be followed as closely as actual construction and work of other trades will permit Govern exact routing of cable and wiring and the locations of outlets by the structure and the equipment served. Take all dimensions from architectural drawings.
- B. Consult all other drawings. Verify all scales and report any dimensional discrepancies or other conflicts to the Project Manager before submitting bid.

- C. All home runs to panelboards are indicated as starting from the outlet nearest the panel and continuing in the general direction of that panel. Continue such circuits to the panel as though the routes were completely indicated. Terminate home runs of signal, alarm, and communications systems in a similar manner.
- D. Avoid cutting and boring holes through structure or structural members wherever possible. Obtain prior approval of The Project Manager and conform to all structural requirements when cutting or boring the structure is necessary and permitted.
- E. Furnish and install all necessary hardware, hangers, blocking, brackets, bracing, runners, etc., required for equipment specified under this Section.
- F. Provide necessary backing required to insure rigid mounting of outlet boxes.
- G. Maintain fire rating at all penetrations of walls, floors, and ceilings.

### 3.2 WIRING METHOD:

- A. Install all wiring in raceway except that lighting circuits in accessible areas above suspended ceilings may be in Type MC cable. Homeruns to panelboards shall be in conduit.
- B. Minimum conduit size shall be 1" when installed underground or under building slabs.
- C. Conduit shall be rigid steel, IMC, EMT, or plastic as follows:
  - 1. Above ground: Use rigid steel, IMC or EMT
  - 2. Wet locations: Rigid steel, IMC, or EMT
  - 3. Hazardous locations: Rigid steel conforming to NEC requirements.
  - 4. Locations subject to mechanical injury: Rigid steel or IMC only.
  - 5. In concrete walls or block walls: Rigid steel or IMC only.
  - 6. Dry locations and not subject to mechanical injury: EMT, IMC or rigid steel conduit.
- D. Underground: Use rigid steel or plastic.
  - 1. Rigid steel conduit, wrapped with 10 mil tape, half lapped, below grade to 3" above grade. Rigid steel conduit may be used for all services.
  - 2. Plastic conduit, any voltage, shall be surrounded by 3" of lean red concrete, all around. Maintain 3" minimum separation between conduits in multiple runs. Provide special configurations as shown on the drawings
  - 3. Risers to grade within switchgear and transformers may be plastic conduit with endbells. Make all exposed risers with rigid steel conduit and rigid steel elbows only. Wrap steel conduit with 10 mil tape, half-lapped below grade to 3" above grade.
  - 4. Burial depth:
    - a. Concrete encased: 24" minimum to top of conduit.
    - b. When installed under buildings the above minimum depth shall be 18" below bottom of floor slab to top of conduits. Backfill trench with smooth sand or provide 95% compaction above 3" sand backfill.
    - c. Underground conduit entering building shall be provided with one 10' section of rigid steel conduit at point of penetration of foundation, footing or basement wall, with approximately equal lengths inside and outside building line.
  - 5. Use flexible steel conduits in the following applications:
    - a. Recessed lighting fixtures.

- b. Motor connections.
- c. Connection between fan plenum and structure.
- d. At expansion joints and seismic separations. Allow for 6" of free movement in any direction at seismic joints.
- e. At transformers and other equipment that produces vibration at wet locations or where exposed to weather, flexible steel conduit shall be liquid tight type.

### 3.3 INSTALLATION OF CONDUITS AND CABLE:

#### A. General:

1. Run all conduits concealed unless otherwise noted or shown.
2. Run exposed conduit parallel to or at right angles to center lines of columns and beams.
3. Run no conduit in concrete slabs or floors except at point of penetration. All penetrations shall be at right angles to slab surfaces.
4. Install 1/8" diameter Tubbs Cordage Company yellow "polyline" or equal 250lb. pull line in all conduits provided under this contract that are intended for future use.
5. Provide pull boxes where shown or as required to limit any conduit run to a maximum of three 90 bends (or equivalent), or to avoid "U" bends.

#### B. Conduit Supports:

1. Support conduits with UL listed steel conduit supports at intervals required by NEC. Wires or sheet metal strips are not acceptable for conduit support.
2. Use conduit hangers for all conduits not directly fastened to structure and for all multiple conduit runs.

#### C. Conduit Penetration:

1. Penetrating foundation wall below floor slab: Install conduit in conduit sleeve or block-out with minimum 1" space around the conduit.
2. Penetrating basement perimeter wall: Conduit shall be cast in concrete or installed in sleeve or block-out. Seal penetration watertight with sealant specified.
3. Penetrating slab on grade: Cast in concrete.
4. Penetrating concrete floor slab above grade: Install conduit in conduit sleeve or block-out or in core drilled hole. Seal penetration with specified sealant.
5. Penetrating fire rated floor or wall: Install conduit in conduit sleeve or framed opening. Seal penetration with fire retardant sealant specified hereinbefore. Fire rating integrity must be preserved.
6. Penetrating roof or exterior wall: Avoid penetrating roof or exterior wall where possible. Where penetrations are necessary, building weatherproof integrity must be preserved.
7. Penetrating sound insulated or fan plenum wall: Install conduit in conduit sleeve and seal penetration.
8. Penetrating non-fire rated dry wall: Conduit sleeves are not required. Seal penetrations with joint compound prior to painting. Make penetrations after wall finish is applied as small as possible and provide with escutcheons, one on each side of wall.
9. Penetrating suspended ceiling: Cut hole as small as possible to permit conduit penetration. Provide escutcheon for each conduit below ceiling.
10. Probe underground conduits and ducts 2" and larger by pulling mandrel 1/4" smaller than the inside diameter.

11. Where flush branch circuit panelboards are shown in walls, stub a minimum of three 1" empty conduits into overhead ceiling spaces and three 1" empty conduits into space below floors (if any) in addition to conduits required for circuit wiring.

### 3.4 INSTALLATION OF WIRES:

- A. Pull no wire into any portion of the conduit system until all construction work which might damage the wire has been completed.
- B. Install all wire continuous from outlet to outlet or terminal to terminal. Splices in cables when required shall be made in handholes, pull boxes or junction boxes. Make branch circuit splices in outlet boxes with 8" of correctly color-coded tails left in the box.
- C. Splices in wires and cables shall be made utilizing materials and methods described above.
- D. All cables and wires passing through vaults and pullboxes shall be full looped around the inside supported on approved nonmetallic racks.
- E. Make all ground, neutral and line connections to receptacle and wiring device terminals as recommended by manufacturer. Provide ground jumper from outlet box to ground terminal of devices when the device is not approved for grounding through the mounting screws.
- F. Megger and record insulation resistances of all 600 volt insulated conductors size #4/0 AWG and larger using a 500 volt megger for one minute. Make tests with circuits isolated from source and load.
- G. Provide Brady wire markers where number of conductors in a box exceeds four.
- H. Conduits containing cables entering building below grade shall be sealed using specified sealants.

### 3.5 WIRE COLOR CODE:

- A. Color code all conductors. Wire sizes #8 AWG or smaller shall have integral color coded insulation. Wire sizes #6 AWG and larger may have black insulation but identified by color coded electrical tape at all junction, splice, pull, or termination points. Color tape shall be applied half lapped to at least 6" of the conductor.
- B. Color code wires as follows:

Conductors	120/208 Volts	277/480 Volts
Phase A	Black	Brown
Phase B	Red	Purple
Phase C	Blue	Yellow
Neutral	White	White or Grey
Ground	Green	Green

- C. Maintain color coding schemes at existing facilities.
- D. Color coding of wires used for signal and communication systems are specified under the respective sections for these systems.

### 3.6 MOUNTING HEIGHTS OF DEVICES:

- A. Unless otherwise noted on drawings, mounting heights of devices shall be as follows:
1. Switches: 48" to top
  2. Receptacles: 16" to top
  3. Telephone & EDP Outlets: 16"
  4. Fire Alarm Pull Stations: 48"
  5. Fire Alarm Strobes: 80"
  6. Install all receptacles uniformly with "U" ground slot up or down as directed by the Project Manager.

**3.7 CONNECTIONS TO EQUIPMENT:**

- A. General: Furnish and install required power supply conduit and wiring to all equipment. See below for other wiring required.
- B. Furnish and install a suitable means of disconnect immediately ahead of and adjacent to each magnetic motor starter or appliance unless the motor or appliance is located adjacent and within sight of the serving panelboard, circuit breaker or switch. Verify all equipment nameplate current ratings prior to installation.
- C. Mount all motor starters and provide all power wiring to them, including those furnished under other sections of specifications.
1. Install all rough-in work for equipment from approved shop drawings to suit the specific requirements of the equipment.
  2. Furnish and install all magnetic motor starters that are shown on the electrical drawings or specified under other Divisions to be furnished under this Division of work. Verify equipment nameplate ratings prior to installation and furnish adequately rated starters for the loads.
  3. Furnish and install manual thermal protection for all motors not integrally equipped with thermal protection.
  4. Furnish 120 volt power to each control panel and time clock requiring a source of power to operate.

**3.8 IDENTIFICATION:**

- A. Provide engraved nameplates, black with white core for switchgear, panels, motor starters, disconnect switches and all associated devices.
- B. Provide transparent tape labels on all lighting switches and convenience and special purpose receptacles to show panel and circuit number to which the device is connected.

**3.9 CONCRETE AND CONCRETE WORK:**

- A. Concrete shall have a 28 day strength of 2500 psi, minimum or as shown on the Drawings. Concrete for encasing electrical conduits shall be mixed with 3 pounds of iron oxide per sack of cement to provide red color.

**3.10 EXCAVATION AND BACKFILL:**

- A. All excavation and backfill required because of this work shall be included. Excavation of trenches shall be sequenced to minimize "open time" and inconvenience.

- B. Trenches shall be cut straight and true and shall be shored and braced where required. See Specifications for Excavation and Back-fill for specific methods and requirements.

**3.11 CONCRETE DUCT BANK CONSTRUCTION:**

- A. Provide approved spacers, chair or donut style, at maximum 5'-0" centers to maintain 2" spacing between conduits.
- B. Anchor the conduits at 10'-0" on centers to prevent floating during concrete pour.
- C. Provide 3" wide yellow "Electric Line", T&B, Westline or equivalent plastic warning tape 18" above duct bank. Provide one warning tape for each 12" width of concrete duct bank or fraction thereof.

**END OF SECTION**



**SECTION 26 05 13**

**MEDIUM VOLTAGE POWER CABLES**

**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 covers single-conductor 15KV and 25KV shielded power cable insulated with an ozone and discharge resistant, flexible, rubber-like dielectric for high voltage applications that shall be suitable for use in wet and dry locations in conduit, underground duct systems, and aerial installations.
- B. Cable shall be rated 105degrees C for normal operation, 130degrees C for emergency overload operation, and 250degrees C for short circuit conditions. Emergency overload operation may occur for periods up to 100 hours per year and with as many as five such 100 hour periods within the lifetime of the cable.

**1.3 QUALITY ASSURANCE**

- A. Factory Tests:
  - 1. Cable shall be factory tested at high voltage AC, high voltage DC, and for corona discharge according to ICEA requirements.
  - 2. Certification of satisfactory completion of factory tests for cables shall be submitted to the Project Manager at the time of cable delivery.

**1.4 REFERENCES**

- A. American Society for Testing and Materials (ASTM): ASTM B-8 and ASTM B-231.
- B. Association of Edison Illuminating Companies (AEIC): AEIC CS6.
- C. Insulated Cable Engineers Association (ICEA): ICEA S-68-516.
- D. Underwriters Laboratories (UL): UL-1072.

**PART 2 - PRODUCTS**

**2.1 ACCEPTABLE MANUFACTURERS**

- A. The products of the following firms shall be considered acceptable:
  - 1. Okonite Co.
  - 2. General Cable: "Unishield"
  - 3. Southwire

## 2.2 MATERIALS

- A. Basic cable construction shall be 1/C Class B copper strand, extruded semiconducting strand screen, EPR insulation, copper tape shield, and a tough, oil-resistant jacket overall.
- B. Conductor size shall be indicated on the Drawings and shall consist of bare soft copper wire. Stranding shall be Class B, stranded or compact and shall meet the electrical resistance requirements of ICEA S-68- 516, Section 2.5.2.
- C. Conductor screen shall consist of an extruded layer of semiconducting thermosetting compound.
- D. The insulation shall be ethylene-propylene rubber and shall meet the electrical and physical characteristics set forth in ICEA S-68-516. Cross-linked polyethylene is not acceptable. Average insulation thickness shall be .220 inches for 15 KV rated cable.
- E. Insulation screen shall be an extruded semiconducting compound.
- F. Copper shield shall be tape sized in accordance with applicable standards.
- G. Overall jacket shall be polyvinyl chloride or polyethylene, according to ICEA S-68-516
- H. The following information shall be printed every 24 inches on the jacket:
  - 1. Manufacturer
  - 2. Insulation thickness and type (shielded)
  - 3. Jacket type
  - 4. Conductor type and size (AWG or kCMIL)
  - 5. Rated voltage
  - 6. Year of manufacture

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Provide an insulated, 600 volt, TW, THW, or THHN copper equipment grounding conductor with all primary cable runs.
  - 1. Size as shown on drawings.
  - 2. Splice grounding conductor with compression connectors and bond to ground bus in each manhole. Do not use manhole ground bus as a splice point.
  - 3. Ground cable shield at splices and terminations with #6 AWG stranded copper wire or approved equal
- B. Noncurrent-carrying metal parts shall be grounded.
- C. Make ground connections with exothermic welding or approved solid copper connectors and brass nuts and bolts.
- D. Protect cables from weather and damage during storage. Keep cable ends sealed during storage and prior to the time cables are terminated.
- E. Cable Pulling:

1. Installation equipment shall be complete with instruments for reading pulling tension values recommended by the cable manufacturer.
  2. Use pulling lubricants only as recommended by the cable manufacturer.
  3. Pull a stiff brush, mandrel and swab through the conduit prior to pulling cable.
  4. Pull at an even rate not to exceed 50 feet per minute.
  5. Basket grips may be used only for pulling short lengths and cables between switchgear and transformers. Pulling tension shall not exceed 1000 pounds per grip.
- F. Support cable reels on sturdy reel supports located sufficiently near the manhole to permit feeding the cable through the manhole opening without rubbing on the sides or on the ground.
- G. Attach pulling line to power cable with an approved swivel clevis to prevent twisting of cables.
- H. All sheaves and similar equipment around which cable is pulled shall have a radius not less than 15 times the outside diameter of the cable. The pull angle shall not exceed 90 degrees.
- I. Install cables along those walls providing the longest route and the maximum spare cable lengths. The bending radius of trained cables shall be not less than 12 times the outside diameter of the cable.
- J. Provide non-metallic cable supports as shown on the Drawings. Support cable and splices on maximum 4 ft. centers. Use heavy duty plastic cable ties to secure cables to insulators
- K. Cable splices and terminations shall be made by certified cable splicers with minimum five years experience in splicing cables of the type being provided under the Contract. Qualifications of cable splicers shall be approved by the Contractor to the Project Manager prior to splicing or termination of cables. Splicing and terminating shall be in accordance with manufacturer's recommendations, utilizing manufacturer approved kits or as specifically shown on the Drawings.
- L. Cable splices and terminations shall be completed without delay once the conductors and insulation are exposed to the atmosphere.
- M. Cables shall be identified in every manhole and pullbox by voltage, circuit name, and location of next accessible point by engraved tags, red with white letters, approximately 3"x5", fastened with #12 copper wire.

### **3.2 TESTING AND FIELD QUALITY CONTROL**

- A. Testing Equipment: Testing equipment and devices used in performing the required tests shall have a calibration sticker affixed to each device stating the date when calibrated, date due for recalibration, and the signature of the individual who did the calibration. In addition to the sticker, a certificate shall accompany the testing equipment stating the standards to which the device was calibrated, the name of the calibrating agency, the name and signature of the calibrating individual, and the brand name and serial number of the device calibrated.
- B. Distribution Conductors 600 Volt Class: All 600 volt class conductors shall be tested to verify that no short circuits or accidental grounds exist. Make the tests shall be made using an instrument which applies a voltage of approximately 1000 volts to provide a direct reading in resistance (Megger).

### **3.3 PRIMARY VOLTAGE CABLE HIGH POTENTIAL TEST:**

- A. All primary cables shall be given D.C. high potential tests after installation. All tests shall be performed in the presence of the Project Manager's representatives and shall be performed to their complete satisfaction. Testing cables shall after all splices and cable terminations are made, but before connections to equipment are made. Wrap open cable ends with plastic or provided similar corona protection. Test each cable with the shields and other cables grounded. Use a standard high potential test set and read the leakage current in micro amperes in the cable at two minute intervals during the test.
- B. Raise the test voltage in 5KV increments from zero to the final test value over a minimum period of ten minutes. Testing time shall be started when the voltage on the cable has attained final test value and shall be continued for at least 10 minutes. EXCEPTION: A "go/no-go" test at the proper test voltage may be accepted by the Project Manager for very short lengths of cable.
- C. DC TEST VOLTAGE, FINAL TEST VALUE
- | Cable Rating | New Cable | Existing Cable |
|--------------|-----------|----------------|
| 5 KV         | 25 KV     | No Test        |
| 15KV         | 50 KV     | No Test        |
- D. Plot the results of the tests, current against voltage at each 5KV increment, after two minutes minimum or after voltage has stabilized to the maximum test value. Plot current against time for 10 minutes in one minute intervals on a separate sheet for each length of cable tested. Identified the curves by the cable to which they apply and record time of test, day, outside temperature, and humidity.
- E. If any primary cable fails, or tests, in opinion of the Project Manager, show unacceptable cable defects all cables in that conduit between the nearest pulling points on each side of the failure shall be withdrawn. If, in the opinion of the Project Manager, other cables that may have been installed in the same duct are not damaged, they may be re-installed, but the failed cable shall be replaced with new cable without additional charge.
- F. After replacement of the faulty cable, and any other damaged cables, all cables of the circuit in that conduit shall be retested. If cable fails again, or if tests, in the opinion of the Project Manager, show unacceptable cable defects, all cables shall be replaced without charge and this procedure shall be repeated until tests prove satisfactory.
- G. Test Reports: Submit two copies of the test result reports to the Project Manager for each cable tested.

### 3.4 PHASING TESTS

- A. Verify by test that the A, B, & C phases of both 12.5kV feeders are connected to the A, B, and C phase at loop switches and feed through transformer bushings. Voltage readings between A-A, B-B and C-C shall be zero.
- B. Use approved phasing test equipment. Do not rely on markings or labels.

**END OF SECTION**

**- SECTION 26 0800 -**

**STARTUP AND TESTING**

**1. GENERAL SCOPE**

**1.1 General**

1. The Contractor is responsible for engaging and paying for the services of a recognized independent testing organization for the purpose of performing inspections and tests as herein specified. The tests and inspections are intended to determine that the equipment is suitable for energizing and that all electrical equipment, both Contractor and Owner supplied, is operational within industry and manufacturer's tolerances, is installed according to specifications, and is safe to energize.
2. Schedule tests and give a minimum of two weeks advance notice to the Project Manager.
3. The work specified in these specifications may involve hazardous voltages, materials, operations, and equipment. The contractor is responsible for safety on the jobsite.
4. Perform all tests in the presence of the District's representative, generally the Inspector of Record (IOR) or the Engineer. The District may require a repeat of tests that are not witnessed.
5. Provide acceptance testing for the major components, according to the *Standard for Acceptance Testing Specifications*, ANSI/NETA ATS-2009. The tests will be performed prior to energizing the new equipment:
  1. Medium Voltage Cable
  2. Medium Voltage Switchgear including Service Equipment
  3. Protective Relays
  4. Batteries and Charger
  5. Instrument Transformers
  6. Secondary Unit Substations
  7. Primary Air Switches and Fuses
  8. Metering and Monitoring
  9. Transformers, including correct tap settings
  10. Vacuum Interrupter
  11. Circuit Breakers including primary injection for circuit breakers 400A and larger.
  12. Ground Fault Protection
  13. Bolted Connections Torque
  14. Include verification of proper grounding and phase rotation at the existing buildings that are connected to new sources.
  15. Grounding Electrode Systems
6. The intent is that every part of the system is tested prior to energizing. Bring any items that appear to require testing but are not included above to the attention of the Engineer.

**2. APPLICABLE REFERENCES**

**2.1 Codes, Standards, and Specifications**

All inspections and field tests shall be in accordance with applicable, codes, standards, and specifications except as provided otherwise herein.

1. American National Standards Institute – ANSI
2. ASTM International - ASTM
3. Institute of Electrical and Electronic Engineers - IEEE
4. National Electrical Manufacturers Association - NEMA
5. CEC 2007/NFPA 70, 2007 California Electrical Code,
6. NFPA 70B *Recommended Practice for Electric Equipment Maintenance*
7. ANSI/NFPA 70E *Standard for Electrical Safety in the Workplace*
8. Occupational Safety and Health Administration – OSHA
9. State and local codes and ordinances
10. Underwriters Laboratories, Inc. - UL
11. Electrical Testing Association – NETA
12. Manufacturer’s instruction manuals for the equipment to be tested.
13. Startup and Testing as specified in individual equipment sections of the Specifications

### **3. QUALIFICATIONS OF TESTING ORGANIZATION AND PERSONNEL**

#### **3.1 Testing Organization**

1. The testing organization shall be an independent, third party entity which can function as an unbiased testing authority, professionally independent of the manufacturers, suppliers, and installers of equipment or systems being evaluated.
2. The testing organization shall be regularly engaged in the testing of electrical equipment devices, installations, and systems.
3. The testing organization shall use technicians who are regularly employed for testing services. An organization having a designation of “NETA Accredited Company” issued by the International Electrical Testing Association meets the above criteria.
5. The testing organization shall submit appropriate documentation to demonstrate that it satisfactorily complies with these requirements. Use test forms provided by the District or similar forms approved by the Engineer

#### **3.2. Testing Personnel**

1. Technicians performing these electrical tests and inspections shall be trained and experienced concerning the apparatus and systems being evaluated. These individuals shall be capable of conducting the tests in a safe manner and with complete knowledge of the hazards involved. They must evaluate the test data and make a judgment on the serviceability of the specific equipment.
2. Technicians shall be certified in accordance with ANSI/NETA ETT-2000, *Standard for Certification of Electrical Testing Personnel*. Provide a foreman with a current certification, Level III or higher, in electrical testing at the test site at all times during a test.

### **4. DIVISION OF RESPONSIBILITY**

#### **4.1 The District**

The District will provide the testing organization with the following:

1. Protective device settings
2. Test Forms

#### **4.2 The Contractor**

Provide the following:

1. A complete set of electrical plans and specifications, including all change orders to the testing organization.
2. Drawings and instruction manuals applicable to the scope of work to the testing organization
3. An itemized description of equipment to be inspected and tested to the testing organization
4. A suitable and stable source of electrical power to each test site
5. Preliminary low-voltage insulation-resistance, continuity, and low-voltage phase rotation tests prior to and in addition to tests specified herein. Contractor is responsible for proper phase rotation and voltage settings at each building.
6. Provide coordination with IOR, the Engineer, and the testing organization
7. Site-specific hazard notification and safety training to the testing organization where special conditions exist.

### **4.3 The Testing Organization**

Provide the following:

1. All field technical services, tooling, equipment, instrumentation, and technical supervision to perform such tests and inspections.
2. Specific power requirements for test equipment to the Contractor
3. A timely notification of any system, material, or workmanship that is found deficient based on the results of the acceptance tests.
4. A written record of all tests and a final report.
5. A summary letter indicating that testing is complete and the equipment is deemed safe to energize. This will be used by the IOR to authorize PG&E to energize the service.

## **5. GENERAL**

### **5.1 Suitability of Test Equipment**

1. All test equipment shall meet the requirements in Section 5.3 and be in good mechanical and electrical condition.
2. Field test metering used to check power system meter calibration must be more accurate than the instrument being tested.
3. Accuracy of metering in test equipment shall be appropriate for the test being performed.
4. Waveshape and frequency of test equipment output waveforms shall be appropriate for the test to be performed and the equipment to be tested.

### **5.2 Test Instrument Calibration**

1. The testing organization shall have a calibration program which assures that all applicable test instruments are maintained within rated accuracy for each test instrument calibrated.
2. The firm providing calibration service shall maintain up-to-date instrument calibration instructions and procedures for each test instrument calibrated.
3. The accuracy shall be directly traceable to the National Institute of Standards and Technology (NIST).
4. Instruments shall be calibrated in accordance with the following frequency schedule:
  1. Field instruments: Analog and Digital, 12 months maximum.
  2. Laboratory instruments: 12 months maximum.
  3. Leased specialty equipment: 12 months maximum.
  5. Dated calibration labels shall be visible on all test equipment.

6. Records which show date and results of instruments calibrated or tested must be kept up to date.
7. Calibrating standard shall be of better accuracy than that of the instrument tested.

### 5.3 Test Report

1. The test report shall include the following:
  1. Summary of project.
  2. Description of equipment tested.
  3. Description of tests.
  4. Test data.
  5. Analysis and recommendations.
2. Test data records shall include the following minimum requirements:
  1. Identification of the testing organization.
  2. Equipment identification.
  3. Humidity, temperature, and other conditions that may affect the results of the tests and/or calibrations.
  4. Date of inspections, tests, maintenance, and/or calibrations.
  5. Identification of the testing technician.
  6. Indication of inspections, tests, maintenance, and/or calibrations to be performed and recorded.
  7. Indication of expected results when calibrations are to be performed.
  8. Indication of as-found and as-left results, as applicable.
  9. Sufficient spaces to allow all results and comments to be indicated.
3. The testing organization shall furnish a copy or copies of the complete report to the owner as specified in the acceptance testing contract.

- END OF SECTION -



**SECTION 26 12 00**

**15KV PADMOUNT VACUUM SWITCH - OIL FILLED**

**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. Padmount Distribution Switch complete with insulating oil.

**1.3 INCORPORATED DOCUMENTS**

- A. Latest applicable NEMA and ANSI standards for padmount, dead front, oil filled switch with vacuum load interrupters.

**1.4 SUBMITTALS**

- A. Submit shop drawings containing information of dimensions, weight, and fabrication details.
- B. Submit paint chip for approval by Architect
- C. Submit manufacturer's test report.

**PART 2 - PRODUCTS**

**2.1 GENERAL DESCRIPTION**

- A. Padmount Switch as Manufactured by Trayer Engineering, No Substitutions.

**2.2 ELECTRICAL CHARACTERISTICS**

- A. Nominal Voltage: 15KV, 3-Phase, 60 Hz.
- B. 6-way, two 600A switched ways and four 200A Switched Ways.
- C. Vacuum Interrupters: 600A, 95KV BIL.
- D. Insulating Liquid: Mineral Oil, ASTM D-3487.

**2.3 HIGH VOLTAGE TERMINATION AND EQUIPMENT**

- A. Single sided access, low base.

- B. Provide parking stands.

## **2.4 CONSTRUCTION**

- A. Construction shall be dead front.
- B. Provide lifting lugs and provisions for jacking, rolling, and skidding.
- C. Provide lugs, designed for CBC 2007, Importance Factor 1.5, for bolting the switch to the pad.
- D. Provide the following accessories:
  - 1. Liquid level indicator.
  - 2. Wind latch.
  - 3. Ground terminals.
- E. Finish the unit according to ANSI standards for surface preparation, primer, and paint durability.  
**Exterior color:** Beige "Desert Tan." Submit paint chip for approval by Architect prior to painting

## **PART 3 - EXECUTION**

### **3.1 FACTORY TESTS**

- A. Perform factory tests according to ANSI Standards and submit test reports to the Owner prior to shipment.

### **3.2 SHIPPING AND DELIVERY**

**END OF SECTION**

**SECTION 26 27 13**

**ELECTRICITY MONITORING  
ENERGY VIEW ONLINE (EVO)**

**PART 1-GENERAL**

**1.1 WORK INCLUDED**

- A. Energy View Online (EVO) proprietary monitoring system at the new building 30, 12 KV main switchgear.

**1.2 SUBMITTALS**

- A. Provide submittals according to Project Basic Requirements

**1.3 RELATED DOCUMENTS**

- A. A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

**PART 2-PRODUCTS**

**2.1 RACEWAY AND WIRING**

- A. Raceways and wiring shall comply with Division 26 00 00 unless otherwise specified herein:
  1. Conductor insulation shall be 600 volt, Type THW or THHN.
  2. Conductors for 120V shall be #12 or larger
  3. Conductors for low voltage shall be #16 or larger
  4. Sensor and signal wiring shall be #18 AWG unless otherwise specifically required by the connected equipment

**2.2 EQUIPMENT FOR ELECTRICAL MONITORING**

- A. EVO Panel - Purchase from distributor Schneider Electric. The EVO Panel shall include:
  1. One Power Logic EGX300 metering platform (one required per site)
  2. One Power Logic EGX100
  3. One 110V ac to 24V DC power transformer
  4. One 2x4 junction box with dual 110V AC outlets installed. Ready for field connection to 110V AC circuit.

Note: Additional electronic monitoring devices and their associated wiring terminal strips may also be required based on possible custom EVO panel requirements that can arise. Contact Schneider Electric, Christopher Wilkins (650-616-7403) for additional information as required.

- B. Contractor shall terminate all wiring to the appropriate terminal strips per the wiring diagram included in this section
- C. Contact Schneider Electric, Christopher Wilkins (650-616-7403) for equipment purchase information and pricing.

### 2.3 REMOTE ENERGY MONITORING SERVICE

- A. The REMOTE ENERGY MONITORING SERVICE shall be available as a SaaS (Software as a Service) platform and not require software to be installed on a local user owned PC. Only a standard web browser such as Windows Explorer, Modzilla or Google Chrome shall be necessary to use the service. The service shall be capable of accepting data from remotely located energy metering devices such as electric, water, gas and steam. Data from these meters shall be “pushed” to the REMOTE ENERGY MONITORING SERVICE via various open protocol methods including: FTP, and Metermail (SNMP). Other methods shall include the use of the manufactures own Slinger application.
- B. The REMOTE ENERGY MONITORING SERVICE shall have a simple user interface for managing account and meter information for each user. The simplicity of the interface shall enable users to become expert in the use or the service with minimal effort or expertise.
- C. The REMOTE ENERGY MONITORING SERVICE shall be capable of providing metering information for Electricity, Water, Steam and Natural Gas usage. (WAGES)
- D. The REMOTE ENERGY MONITORING SERVICE shall provide for easy report generation from a list of standard reports which shall include: Summary Statistics, Comparison Statistics, Comparison Graph, Average Profiles, Load Duration Curve, Load Profile, Usage History, Bill Calculation, Google Map and Emissions Report
- E. The REMOTE ENERGY MONITORING SERVICE shall allow selection of any date range for report generation using a quick selection menu on the home screen. The available meter data date range available shall be clearly identified for the user.
- F. The REMOTE ENERGY MONITORING SERVICE shall provide for the ability to Normalize meter data to better represent energy use conditions for the following parameters: Square Footage, Occupancy, Hours of Operation and Units of Production.
- G. The REMOTE ENERGY MONITORING SERVICE shall also provide the ability for Weather Normalization to more accurately represent actual energy requirements under various environmental conditions for the following values: HDD, CDD, (heating degree days / cooling degree days) HDD+CDD and 30 Year Typical
- H. The REMOTE ENERGY MONITORING SERVICE shall include Emission Reporting which will calculate the amount of CO<sub>2</sub> based on the energy consumed during a specified date range against a specified emission factor. The information displayed shall be Total energy in Original Unit of Measure (BTU for gas, KWh for electricity), The Total Energy in kWh, Emission Factor, CO<sub>2</sub> Emission in lbs CO<sub>2</sub> for the account and lbs CO<sub>2</sub>/sq ft. If more than one type of energy is used, the values due to each type of energy shall be displayed. Further on board analysis of target, target value to date and reduction to date shall be calculated by the REMOTE ENERGY MONITORING SERVICE and displayed in a graphical and table format.
- I. The REMOTE ENERGY MONITORING SERVICE shall allow any of the reports to be saved as a pdf, sent to a printer or saved as a Memorized report. Memorized reports shall also be available as a webwidget.
- J. The REMOMTE ENERGY MONITORING SERVICE shall include a standard Dashboard which will display user designated memorized reports in Webwidget format. Information displayed shall be dynamically updated as new data is received. User shall be able to arrange the widgets simply by dragging and dropping as desired. Clicking on “view” shall provide immediate access to the full report.

- K. The REMOTE ENERGY MONITORING SERVICE shall also provide for reports to be exported to 3rd party web dashboards such as iGoogle using Webwidgets. This capability shall provide for ease in sharing of energy data to users not logged into the REMOTE ENERGY MONITORING SERVICE. The functionality shall also be able to support applications such as Energy Kiosks
- L. The REMOTE ENERGY MONITORING SERVICE shall include a Google Map report which will provide users quick access to every site in the monitoring portfolio presented in a standard Google Map format. Every site shall be shown with a color coded market depending on the level of CO2 emissions. The color of the market (green, red or gray) shall announce which levels have exceeded specified targets. Clicking on a market shall cause an Info Window to appear showing the site name, the site location, the type of site plus Total Energy and Total CO2 year to date.
- M. The REMOTE ENERGY MONITORING SERVICE shall include a Historical reporting feature whereby stored meter data can be compared on a daily, monthly or annual period. For example a meter can be compared to the same month year over year (ie, January 2009 to 2010) day to day (Tues to Tues), etc.
- N. The REMOTE ENERGY MONITORING SERVICE shall support “interval data” readings of electricity and other utility values imported from a database. For example: kWh’s (Energy) and kWd (Demand) from each meter in the system -- typically sampled at a 15, 30, or 60 minute intervals.
- O. The REMOTE ENERGY MONITORING SERVICE shall support grouping and aggregation of meters to combine multiple meters into one aggregate total reading. For example: multiple meters belong to one Tenant.
- P. The REMOTE ENERGY MONITORING SERVICE shall support the following User-configurable Utility Bill calculations:
- Electrical Energy charges
  - Power Factor charges
  - Gas Usage charges
  - Customer Charge
  - Custom Miscellaneous charges
  - Demand charges
  - Water Consumption charges
  - Taxes
  - Delivery Charges
- Q. The REMOTE ENERGY MONITORING SERVICE shall provide support for multiple Utility Rates within the same application software program. When multiple rates are configured the service shall be capable of providing detailed “what if” analysis reports showing which rate will provide the best energy cost opportunity for the user.
- R. The REMOTE ENERGY MONITORING SERVICE shall provide a utility grade the Validation, Editing and Estimation (VEE) function to ensure accuracy of electrical meter data used to generate billing reports. This feature shall be user configurable and function by filling in missing data from large and small gaps as well as check for spikes and remove as determined by the algorithms
- S. The REMOTE ENERGY MONITORING SERVICE shall be fully administered and supported by the service provider. The following shall be included with the service
1. Extensive on-line Help screens.
  2. Remote configuration of communications devices required to push data to the Service (on-site meter configuration shall not be included as part of the service).
  3. System manufacturer shall maintain a full-time Technical Support group
    - a. Telephone Tech Support Center
    - b. Tech Support Web Site

4. System manufacturer shall maintain a full-time Engineering Services group
  - a. System integration capabilities
  - b. Energy usage consulting capabilities
  - c. Power Quality consulting capabilities
5. System manufacturer shall maintain a full-time Customer Training group

### **PART 3 – EXECUTION**

#### **3.1 EQUIPMENT, CONDUIT AND WIRING INSTALLATION**

- A. Furnish and install all labor, materials, equipment, and service necessary to install and commission a complete and operable EVO Monitoring System
- B. Mount EVO Panel on the wall at the location shown on the Drawings and provide 120Volt Power to the panel. The power source shall be a separate line with its own circuit breaker or circuit protection device, though it can share the same power supply as the BTU meter. Use a three wire service in which one wire is protective earth ground.
- C. Install CAT 5 cable and RJ45 connector from the EVO Panel to an adjacent Network Outlet. Final connections to the IT switch to be made by the District's Information Technology Department.
- D. Connect the PG&E meter pulse conductors to EVO. There are no other inputs at this time.
- E. Coordinate with Schneider Electric to verify that they are able to "view" all installed components from a remote location. Repair or replace malfunctioning metering equipment or correct test setup; then retest.

#### **3.2 CLEANING AND PROTECTION**

- A. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

**END OF SECTION**

## SUPPORTED DEVICE TYPES

The EGX supports the following device types:

### **Circuit Monitors**

CM100/200  
CM2000  
CM3000  
CM4000  
ION7500  
ION7550  
ION7600  
ION7650

### **Power Meters**

PM9c  
PM200  
PM300  
PM500  
PM600  
PM700  
PM800  
PM1000  
PM5000  
ION6200 (Standard and Mega)  
ION7300

### **Energy Meters**

Energy Meter  
Enercept  
E5600  
EM26-96  
ION8600

### **Multi-Circuit Monitors**

BCPM-Model A  
BCPM-Model A  
BCPM-Model B  
BCPM-Model C  
BCM  
MCM

### **Digital Meters**

DM6000

### **Protective Relays**

Sepam 2000  
Sepam Series 10  
Sepam Series 20  
Sepam Series 40  
Sepam Series 80

### **Circuit Breakers**

Compact NSX-A  
Compact NSX-E

### **Power Factor Controller**

Varlogic

### **Trip Units**

Micrologic A  
Micrologic E  
Micrologic H  
Micrologic P

### **Overload Relays (SSOLR)**

MotorLogic Plus  
MotorLogic Plus II

### **Soft Starters Drives**

ATS48 ATV61  
MVSS/RVSS ATV71

### **Digital Temp Controller**

Model 98

### **Active Harmonic Filter**

Accusine

### **Motor Management**

TeSys T

*NOTE: The above list of supported devices was accurate at the time this document was published. Check [www.schneider-electric.com](http://www.schneider-electric.com) for updates.*





**SECTION 26 34 60**

**METAL-CLAD SWITCHGEAR - MEDIUM VOLTAGE**

**PART 1 PRODUCTS**

**1.01 SCOPE**

- A. The Contractor shall furnish and install the equipment as specified herein and as shown on the contract drawings.

**1.02 REFERENCES**

- A. The metal-clad switchgear and all components shall be designed, manufactured, and accordance with the latest applicable standards of NEMA SG-4 and SG-5, and but not limited to, ANSI/IEEE 37.20.2.

**1.03 SUBMITTALS - FOR REVIEW/APPROVAL**

- A. The following information shall be submitted to the Engineer and to PG&E for approval prior to fabrication:
  - 1. Master drawing index
  - 2. Front view elevation
  - 3. Floor plan
  - 4. Top view
  - 5. Single line diagram
  - 6. Circuit breaker and trip circuit breaker three line diagram
  - 7. Nameplate schedule
  - 8. Component list
  - 9. Conduit entry/exit locations
  - 10. Assembly ratings including:
    - a. Short-circuit rating
    - b. Voltage
    - c. Continuous current
    - d. Basic impulse level for equipment over 600 volts

11. Major component ratings including:
    - a. Voltage
    - b. Continuous current
    - c. Interrupting ratings
  12. Cable terminal sizes
  13. Product data sheets
  14. Batteries and Battery Charger
  15. Current Transformers
- B. Where applicable, the following additional information shall be submitted to the Engineer:
1. Connection details between close-coupled assemblies
  2. Composite floor plan of close-coupled assemblies
  3. Key interlock scheme drawing and sequence of operations
  4. Descriptive bulletins

#### **1.04 SUBMITTALS - FOR CONSTRUCTION**

- A. The following information shall be submitted for record purposes:
1. Final as-built drawings and information for items listed in Paragraph 1.04, and shall incorporate all changes made during the manufacturing process.
  2. Wiring diagrams
  3. Certified production test reports
  4. Installation information including equipment anchorage provisions
  5. Seismic certification as specified
- B. Qualifications: The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.
- C. Provide Seismic tested equipment as follows:
1. The equipment and major components shall be suitable for and certified by actual seismic testing to meet all applicable seismic requirements of the 2007 California Building Code for Importance Factor=1.5.
  2. The following minimum mounting and installation guidelines shall be met, unless specifically modified by the above referenced standards.
    - a. The Contractor shall provide equipment anchorage details, coordinated with the equipment mounting provision, prepared and stamped by a licensed civil engineer in the

state. Mounting recommendations shall be provided by the manufacturer based upon approved shake table tests used to verify the seismic design of the equipment.

- b. The equipment manufacturer shall certify that the equipment can withstand, that is, function following the seismic event, including both vertical and lateral required response spectra as specified in above codes.
- c. The equipment manufacturer shall document the requirements necessary for proper seismic mounting of the equipment. Seismic qualification shall be considered achieved when the capability of the equipment, meets or exceeds the specified response spectra.

**1.05 REGULATORY REQUIREMENTS: SEE SECTIONS 20 00 00 AND 01 41 00**

**DELIVERY, STORAGE AND HANDLING**

- A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.
- B. Shipping groups shall be designed to be shipped by truck, rail, or ship. Indoor groups shall be bolted to skids. Breakers and accessories shall be packaged and shipped separately.
- C. Switchgear shall be equipped to be handled by crane. Where cranes are not available, switchgear shall be suitable for skidding in place on rollers using jacks to raise and lower the groups.
- D. Switchgear being stored prior to installation shall be stored so as to maintain the equipment in a clean and dry condition. If stored outdoors, indoor gear shall be covered and heated, and outdoor gear shall be heated.

**1.06 OPERATION AND MAINTENANCE MANUALS**

- A. Equipment operation and maintenance manuals shall be provided with each assembly shipped, and shall include instruction leaflets and instruction bulletins for the complete assembly and each major component.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS: SQUARE D, EATONUTLER-MME INDUSTRIAL ELECTRICAL MANUFACTURING (IEM)**

The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the specification and manufactured by others not named will be considered according to Section 01 60 00, Article 1.3.

**2.02 RATI**

- A. The switchgear described in this specification shall be designed for operation on a 15 kV, three-phase, 3- wire, ungrounded 60-hertz system.

- B. Each circuit breaker shall have the following ratings:

Maximum Voltage	15 kV
BIL Rated	95 kV Peak
Continuous Current (5/15 kV)	1200Ampere]
Short-Circuit Current at rated Maximum kV	18 kA RMS sym
Rated Voltage Range Factor K	1.3
Closing and Latching Capability	62 kA Crest
Maximum Symmetrical Interrupting and 3-Second Rating	25 kA RMS SYM
Nominal 3-Phase MVA Class	500MVA
Rated Interrupting Time	5 Cycle

### 2.03 CONSTRUCTION

- A. The switchgear assembly shall consist of individual vertical sections housing various combinations of circuit breakers and auxiliaries, bolted to form a rigid metal-clad switchgear assembly. Metal side sheets shall provide grounded barriers between adjacent structures and solid removable metal barriers shall isolate the major primary sections of each circuit. Hinged rear doors, complete with provisions for padlocking, shall be provided.
- B. The stationary primary contacts shall be silver-plated and recessed within insulating tubes. A steel shutter shall automatically cover the stationary primary disconnecting contacts when the breaker is in the disconnected position or out of the cell. Provide rails to allow withdrawal of each 15 kV circuit breaker for inspection and maintenance without the use of a separate lifting device.

### 2.04 BUS

- A. The main bus shall be copper with fluidized bed epoxy flame-retardant and track-resistant insulation. The bus supports between units shall be flame-retardant, track-resistant, glass polyester. The switchgear shall be constructed so that all buses, bus supports and connections shall withstand stresses that would be produced by currents equal to the momentary ratings of the circuit breakers. Main bus for 15 kV shall be rated 1200 amperes. Insulated copper main bus shall be provided and have provisions for future extension. All bus joints shall be plated, bolted and insulated with easily installed boots. The bus shall be braced to withstand fault currents equal to the close and latch rating of the breakers. The temperature rise of the bus and connections shall be in accordance with ANSI standards and documented by design tests.
- B. A copper ground bus shall extend the entire length of the switchgear.

### 2.05 WIRING/TERMINATIONS

- A. The switchgear manufacturer shall provide suitable terminal blocks for secondary wire terminations and a minimum of 10% spare terminals shall be provided. One control circuit cutout device shall be provided in each circuit breaker housing. Switchgear secondary wire shall be #14 AWG, type SIS rated 600 volt, 90 degrees C, furnished with wire markers at each termination. Wires shall terminate on terminal blocks with marker strips numbered in agreement with detailed connection diagrams.

- B. Incoming line and feeder cable lugs of the type and size indicated elsewhere shall be furnished.

## **2.06 CIRCUIT BREAKERS**

- A. The circuit breakers shall be horizontal drawout type, capable of being withdrawn on rails. The breakers shall be operated by a motor-charged stored energy spring mechanism, charged normally by a universal electric motor and in an emergency by a manual handle. The primary disconnecting contacts shall be silver-plated copper.
- B. Each circuit breaker shall contain three vacuum interrupters separately mounted in a self-contained, self-aligning pole unit, which can be removed easily. The vacuum interrupter pole unit shall be mounted on glass polyester supports. A contact wear gap indicator for each vacuum interrupter, which requires no tools to indicate available contact life, shall be easily visible when the breaker is removed from its compartment. The current transfer from the vacuum interrupter moving stem to the breaker main conductor shall be a non-sliding design. The breaker front panel shall be removable when the breaker is withdrawn for ease of inspection and maintenance.
- C. The secondary contacts shall be silver-plated and shall automatically engage in the breaker operating position, which can be manually engaged in the breaker test position.
- D. Interlocks shall be provided to prevent closing of a breaker between operating and test positions, to trip breakers upon insertion or removal from housing and to discharge stored energy mechanisms upon insertion or removal from the housing. The breaker shall be secured positively in the housing between and including the operating and test positions.
- E. The breakers shall be electrically operated by the following control voltages:

48 volt DC close and 48 volt DC trip.

Each breaker shall be complete with control switch and red and green indicating lights to indicate breaker contact position.

- F. AC control voltage shall be derived from a control power transformer mounted in the switchgear
- F. DC control voltage shall be supplied by premium maintenance free batteries and charger furnished with the switchgear. The charger shall be float type with equalize function.

## **2.07 PROTECTIVE RELAYS**

- A. The switchgear manufacturer shall furnish and install, in the metal-clad switchgear, the quantity, type and rating of protection relays as indicated on the drawings and described hereafter in this specification.
- B. Microprocessor-Based Protective Relays
  1. Main: Two separate Schweitzer SEL 501, connectorized, wired for redundant operation.
  2. Feeders: One Schweitzer SEL 501 for each feeders, connectorized.

## **2.08 AUXILIARY DEVICES**

- A. Ring type current transformers shall be furnished as indicated on the contract drawings. The thermal and mechanical ratings of the current transformers shall be coordinated with the circuit breakers. Their accuracy rating shall be equal to or higher than ANSI standard requirements. The standard location for the current transformers on the bus side and line side of the 15 kV breaker units shall be front accessible to permit adding or changing current transformers without removing high-voltage insulation connections. Shorting terminal blocks shall be furnished on the secondary of all the current transformers.
- B. Voltage and control power transformers of the quantity and ratings indicated in the detailed specification shall be supplied. Voltage transformers shall be mounted in drawout drawers contained in an enclosed auxiliary compartment. Control power transformers up to 15 kV, 15 kVA, single-phase shall be mounted in drawout drawers.. Rails shall be provided as applicable for each drawer to permit easy inspection, testing and fuse replacement. Shutters shall isolate primary bus stabs when drawers are withdrawn.
- C. A mechanical interlock shall be provided to require the secondary breaker to be open before the CPT drawer or CPT primary fuse drawer can be withdrawn.
- D. Provide 3-18KV Distribution Class lightning arresters on the line side of the man circuit breaker.

## **2.09 UTILITY METERING**

- A. Where shown on drawings, provide separate barriered-off utility metering compartment or structure complete with hinged sealable door. Bus work shall include provisions for mounting utility company current transformers and potential transformers as required by EUSERC and approved by PG&E.

## **2.10 ENCLOSURES**

- A. The switchgear described in these specifications shall be weatherproof, aisleless construction for outdoor service. Each shipping group shall be mounted upon an integral base frame with a weatherproof enclosure for assembly in the field into a complete metal-enclosed switchgear assembly with a weatherproof door provided on the breaker drawout side of each vertical section.
- B. Each vertical section of switchgear shall be provided with space heaters. Tubular type heaters operated at half voltage for long life shall be supplied. 250-volt rated heaters shall be used at 120 volts respectively. Power for space heaters shall be furnished from the control power transformer mounted in the switchgear.
- C. Heaters shall be wired to provide temporary heating during storage

## **2.11 NAMEPLATES**

- A. Engraved nameplates, mounted on the face of the assembly, shall be furnished for all main and feeder circuits as indicated on the drawings. Nameplates shall be laminated plastic, black characters on white background, and secured with screws. Characters shall be 3/16-inch high, minimum. Furnish master nameplate for each switchgear lineup giving information in accordance

with IEEE Std. C37.20.2-1999, Section 7.4.1. Circuit nameplates shall be provided with circuit designations as shown on purchaser's single-line diagrams.

- B. Control components mounted within the assembly, such as fuse blocks, relays, pushbuttons, switches, etc., shall be suitably marked for identification corresponding to appropriate designations on manufacturer's wiring diagrams.

## **2.12 FINISH**

- A. The finish shall consist of a coat of gray (ANSI-61), thermosetting, polyester powder paint applied electrostatically to pre-cleaned and phosphatized steel and aluminum for internal and external parts. The coating shall have corrosion resistance of 600 hours to 5% salt spray.

## **2.13 ACCESSORIES**

- A. The switchgear manufacturer shall furnish accessories for test, inspection, maintenance and operation, including:
  - 1. One – Maintenance tool for manually charging the breaker closing spring and manually opening the shutter
  - 2. One – Levering crank for moving the breaker between test and connected positions
  - 3. One – Test jumper for electrically operating the breaker while out of its compartment
  - 4. One – Breaker lifting yoke used for attachment to breaker for lifting breaker on or off compartment rails, when applicable
  - 5. One – Set of rail extensions and rail clamps, when applicable
  - 6. One – Ramp for rolling breaker mounted in lower compartment directly onto the floor

## **2.14 CORONA FREE DESIGN**

- A. The switchgear shall be corona free by design and shall be tested for partial discharges in accordance with EEMAC standard G11-1. The corona discharges measured during the tests shall be less than 100 picocoulombs.

## **2.15 BILLS OF MATERIAL**

- A. The metal-clad switchgear auxiliary section for control and instrumentation shall include the following:
  - 1. One – 15 kVA. Single-phase control power transformer
  - 2. Panelboard supplying auxiliary equipment and 4 spare 20A/1P circuit breakers for Owner's equipment
  - 3. Batteries and Charger
  - 4. Heaters

5. Volt Meter with Switch
  6. Additional requirements as shown on the plans
- B. The metal-clad switchgear main circuit breaker section for control of a main circuit breaker shall include the following:
1. One – Drawout power circuit breaker rated 1200 amperes
  2. Three – Current transformers, single secondary
  3. One – Circuit breaker control switch with red and green indicating lights
  4. Two - SEL 501 microprocessor-based three-phase and ground overcurrent relays , ANSI device numbers 51/50 and 51/50/N
  5. One – Nameplate
  6. One – Set of cable lugs
- C. Each metal-clad switchgear feeder breaker section for control of a feeder circuit breaker shall include the following:
1. One – Drawout power circuit breaker rated 1200 amperes
  2. Three – Current transformers, single secondary
  3. One – Circuit breaker control switch with red and green indicating lights
  4. One – SEL 501 microprocessor-based three-phase and ground relays for every circuit breakers, ANSI device numbers 51/50 and 51/50/G. Wire for redundant protection
  5. One – Nameplate
  6. One – Microprocessor-based metering system
  7. One – Set of cable lugs
  8. One – Zero sequence current transformer

### **PART 3 EXECUTION**

#### **3.01 FACTORY TESTING**

- A. The following standard factory tests shall be performed on the circuit breaker element provided under this section. All tests shall be in accordance with the latest version of ANSI standards.
1. Alignment test with master cell to verify all interfaces and interchangeability
  2. Circuit breakers operated over the range of minimum to maximum control voltage
  3. Factory setting of contact gap



4. One-minute dielectric test per ANSI standards
  5. Final inspections and quality checks
- B. The following production test shall be performed on each breaker housing:
1. Alignment test with master breaker to verify interfaces
  2. One-minute dielectric test per ANSI standards on primary and secondary circuits
  3. Operation of wiring, relays and other devices verified by an operational sequence test
  4. Final inspection and quality check
- C. The manufacturer shall provide three (3) certified copies of factory test reports.

**3.02 FIELD QUALITY CONTROL (TESTING AND STARTUP\_**

- A. Provide NETA standard acceptance testing according to Testing and Startup Specifications
- B. Do not energize equipment until testing is satisfactorily completed and documented.

**3.03 TRAINING**

- A. The Contractor shall provide a training session for up to five (5) owner's representatives for 1 normal workday at a job site location determined by the owner.
- B. The training session shall be conducted by a manufacturer's qualified representative. Training program shall include instructions on the assembly, circuit breaker, protective devices, and other major components.

**3.04 INSTALLATION**

- A. The Contractor shall install all equipment per the manufacturer's recommendations and contract drawings.
- B. All necessary hardware to secure the assembly in place shall be provided by the Contractor.

**3.05 FIELD ADJUSTMENTS**

- A. The relays shall be set in the field during testing by a qualified representative of the manufacturer, or independent testing agency retained by the Contractor, in accordance with settings provided by the Engineer.

**END OF SECTION**



**SECTION 26 46 20**

**LOADCENTER 1 & 2  
(SECONDARY UNIT SUBSTATION)**

**PART 1 - GENERAL**

**1.1 SCOPE**

- A. Furnish and install the unit substation complete from incoming line to outgoing load terminals.
- B. The unit substation consists of the incoming primary power section, the transformer, and the low voltage section including circuit breakers and metering equipment. The low voltage distribution section shall be a compartmented low voltage distribution switchboard. The manufacturer shall coordinate all of the components and provide a single warranty for the entire assembly.
- C. Connections between the primary switch and the transformer may be copper cable or bus. Connections between the transformer and the secondary shall be by flexible bus or braid.
- D. The equipment and major components shall be suitable for and certified by actual seismic testing to meet all applicable seismic requirements of the 2007 California Building Code for Importance Factor=1.5.

**1.2 REFERENCES:**

- A. The Unit Substation and all components shall be designed, manufactured and tested in accordance with the latest applicable standards of NEMA and ANSI. The transformer and distribution switchboard shall be UL Listed.
- B. Acceptance testing shall according to the Acceptance Testing Specifications of the National Electrical Testing Association (NETA).

**1.3 SUBMITTALS FOR APPROVAL**

- A. The following information shall be submitted to the Engineer.
  - 1. Master drawing index.
  - 2. Front view elevation
  - 3. Floor plan.
  - 4. Top view.
  - 5. Single line.
  - 6. Schematic diagram.
  - 7. Nameplate schedule.
  - 8. Component list.
  - 9. Conduit entry/exit locations.
  - 10. Assembly ratings including:
    - a. Short circuit rating.
    - b. Voltage.
    - c. Continuous current.
    - d. Basic Impulse level for equipment over 600 volts.
    - e. KVA.
  - 11. Major component ratings including:
    - a. Voltage.
    - b. Continuous current.
    - c. Interrupting ratings.

12. Cable terminal sizes.
13. Impedance for transformers.

- B. Submit the key interlock scheme drawing and sequence of operations.
- C. Submit four (4) copies of the above information.

#### **1.4 SUBMITTALS FOR CLOSEOUT**

- A. The following information shall be submitted for record purposes prior to final payment.
  1. Final as-built drawings and information for items listed in section 1.04.
  2. Wiring diagrams.
  3. Certified production test reports.
  4. Installation information.
  5. Seismic certification and equipment anchorage details.
  6. Field testing report.
- B. Submit four (4) copies of the above information.

#### **1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Equipment shall be handled and stored according to with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

#### **1.6 OPERATION AND MAINTENANCE MANUALS**

- A. Four (4) copies of the equipment operation and maintenance manuals shall be provided prior to final payment.
- B. Operation and maintenance manuals shall include the following information:
  1. Instruction books and /or instruction leaflets.
  2. Recommended renewal parts list.
  3. Drawings and information required by section 1.06.

### **PART 2 - PRODUCTS**

#### **2.1 ACCEPTABLE MANUFACTURERS**

- A. Eaton / Cutler-Hammer.
- B. Industrial Electrical Manufacturing Co. (IEM)
- C. Siemens
- D. Square D

#### **2.2 RATINGS**

- A. The incoming Primary Switch Section Ratings shall be as follows:
  1. Nominal System Voltage: 12,470V, three-phase, three-wire
  2. Maximum Design Voltage: 15KV
  3. Basic Impulse Level: 95KV
  4. Bus Continuous Current: 600 Amperes

- 5. Momentary Current: 40kA, Asym.
- 6. Two Second Current: 25 kA, Asym

B. The transformer ratings shall be as follows:

kVA	1000
Class	AA, FA
Frequency	60 HZ
Insulation Class	H
Phase	3
Temperature Rise	115 degrees C
Nominal Voltage,	12,470V Delta, Primary
Winding Material	Copper
Primary BIL Rating	60kV
Nominal Voltage, Secondary	480Y/277 Volts
Secondary BIL Rating	10 kV
Primary Voltage Taps:	2 @ 2 2 % FCAN and FCBN
Impedance:	5%, Minimum

C. The Distribution Section ratings shall be as follows:

Nominal System Voltage	480Y/277, 3φ, 4-wire
Frequency	60 HZ
Bus Continuous Current	1600 Amperes
Bus Bracing Current	50 kA

### 2.3 CONSTRUCTION

- A. The switch, transformer and secondary low-voltage apparatus shall be enclosed in separate steel structures connected form a complete assembly.
- B. The manufacturer shall supply a channel base to facilitate movement into position by rolling or jacking and to provide the means for bolting the substation securely to the floor.
- C. Interconnections between the switch, transformer and the low voltage apparatus shall be factory provided and disconnected for shipping.
- D. The entire assembly shall be front and rear accessible. All controls and devices requiring maintenance, including tap changers shall be accessible from the front. Cable connections shall be accessible from the rear. .

### 2.4 BUS

- A. All phase bus conductors shall be copper and be mounted on indoor insulators.
- B. Ground bus conductor shall be copper and be directly fastened to a bare metal surface of each vertical section for the entire length of the assembly.
- C. Provide a full-size neutral bus. Bus bar taps for panels with single-pole branches shall be arranged for sequence phasing of the branch circuit devices. Neutral busing shall have a suitable lug for each outgoing feeder requiring a neutral connection.

**2.5 WIRING/TERMINATIONS**

- A. The primary switch section shall have provisions for terminating the incoming primary feeder cable. The type of termination, entry location, and the size and type of incoming cable shall be as shown on the drawings.
- B. Small wiring, fuse blocks, and terminal blocks within the vertical section shall be furnished as indicated on the drawings. Each control wire shall be labeled with wire markers. Terminal blocks shall be provided for customer connections to other apparatus.

**2.6 PRIMARY LOAD INTERRUPTER SWITCH SECTION**

- A. The primary disconnect switch shall be load interrupting with quick-make, quick-break stored energy manual operating mechanism. It shall be three-pole, two-position gang operated.
- B. Current limiting fuses with a short circuit interrupting rating of 50,000 amperes RMS symmetrical shall be supplied fixed mounted on the load side of each switch pole. The fuse continuous current rating shall be in accordance with the manufacturer's recommendation. Fuses shall be of the non-indicating type removable from the front without special tools.
- C. Access to fuses while energized shall be positively prevented through a mechanical interlock system which keeps the section front door held closed when the switch is in the closed position.
- D. Any internal parts that remain energized with the switch open shall be guarded by a fixed internal safety barrier to prevent inadvertent contact by operating or maintenance personnel with the door open. Interphase insulating barriers shall be provided as needed for the voltage class to isolate switch and fuse poles from each other and from grounded metal.
- E. Provision shall be made for operating the switch handle without opening the full length door.
- F. Means shall be provided to padlock the switch in the open position.
- G. Provide an inspection window that permits a full view of the position of all three switch blades.

**2.7 TRANSFORMER SECTION**

- A. A three-phase, 60 Hz, ventilated dry-type, copper wound, transformer shall be supplied as a separate section. The insulation system shall be based on 220 degree C insulating materials. The maximum ambient temperature shall not exceed 40 degrees C.
- B. Primary taps shall consist of full capacity 2-22 % above normal and 2-22% below normal voltage.
- C. Provide a forced air (FA) cooling package that allows an increase in KVA rating by 33%. Include fans, temperature monitor, and automatic control unit. The control unit shall be designed to measure temperature in all three windings and display current and maximum temperature. Provide manual and automatic control and provisions for remote alarming of over temperature conditions. Provide control power from the secondary side of the transformer including a control power transformer.

**2.8 LOW-VOLTAGE DISTRIBUTION SECTION**

- A. The low-voltage distribution section shall be in a completely separate self supporting structure with each circuit breaker in a separate compartment. Small wiring, necessary fuse blocks, and terminal blocks within the enclosure shall be furnished as required. Terminal blocks shall be provided for all groups of control wires leaving the enclosure. All control wiring shall be marked.

- B. Bus bars shall be copper with bolted connections at joints. The bus bars shall be of sufficient size to limit the temperature rise to 65 degrees C and rated to withstand mechanical forces exerted when a short circuit current of 50,000 amperes symmetrical flows through them. Provide full capacity neutral.
- C. The main circuit breaker shall be manually operated, draw-out, insulated case type with microprocessor based RMS sensing trip units.
- D. The feeder circuit breakers shall be molded case type with quantities and frame/trip sizes shall be as shown on the Drawings. Feeder circuit breakers shall be microprocessor based with RMS sensing trip units including ground fault protection on all feeder circuit breakers. Include neutral conductor current sensors.
- E. Circuit breakers shall have a minimum symmetrical interrupting capacity as indicated on the drawings but in no case less than the available fault current at the transformer secondary.
- F. Interchangeable rating plugs shall establish the continuous trip ratings of each circuit breaker. Rating plugs shall be fixed or adjustable as indicated. Rating plugs shall be interlocked so they are not interchangeable between frames, and interlocked such that a breaker cannot be closed and latched with the rating plug removed.
- G. System coordination shall be provided by the following time-current curve shaping adjustments:
  - Adjustable long time pick-up and delay
  - Adjustable short time pick-up and delay
  - Adjustable instantaneous pick-up
  - Adjustable ground fault pick-up and delay
- H. Provide bussed spaces for future circuit breakers.
- I. Include a provision on each circuit breaker for locking in the off position (LockOut/TagOut).

## **2.9 CUSTOMER METERING**

- A. Provide one Schneider ION Model 7330 digital watt-hour meter with communications option. Provide 7330 meters with 120 volt sensing input only and voltage transformers for 480 volt systems.
- B. Locate the meter on a front hinged door at 42" to 52" to the centerline of the meter from the walking surface.
- C. Wire current transformers to shorting type meter test switches, States or equal. Pin type shorting blocks are not acceptable.
- D. Provide potential transformers with 2.4:1 ratio on 480 volt systems. Provide primary and secondary fuses with disconnecting means.
- E. Provide 120 volt control power from a separate control transformer or from the potential transformers for 480 volt systems. Provide a control power disconnect switch to the digital meter. Provide primary fuse protection and disconnecting means if a control transformer is provided.
- F. NAMEPLATES: Provide an engraved nameplate for each circuit breaker according to the Drawings.
- G. PROGRAMMING: Include programming of the meter for this application by factory trained personnel. Set the demand function for 15 minutes with a 5 minute sliding window.

**2.10 FINISH**

- A. Prior to assembly, all enclosing steel shall be thoroughly cleaned and primed. Provide an electrostatic or epoxy paint with a thickness of not less than 1.5 mils. The finish shall have the following properties:

Impact resistance (ASTM D-2794)	60 Direct/60 Indirect
Pencil Hardness (ASTM D-3363)	H
Flexibility (ASTM D-522)	Pass 1/8 inch mandrel
Salt Spray (ASTM B117-85 [20])	600 hours
Color	ANSI 61 Gray

**PART 3 - EXECUTION**

**3.01 FACTORY TESTING**

- A. Perform factory tests according to ANSI C57.12.90 and submit certified test reports submitted to the Project Manager prior to installation of transformer.
- B. Report shall include the following test results:
1. Winding to winding and winding to ground resistance measurement.
  2. Ratio tests on rated voltage connection and all tap connections.
  3. Polarity and phase relation tests on the rated voltage connection.
  4. No load loss.
  5. Exciting current.
  6. Impedance and load loss at full load.
  7. Applied potential test.
  8. Induced potential test.
  9. Impulse test.
- C. The manufacturer shall provide three (3) certified copies of factory test reports.
- D. INSTALLATION: The Contractors shall install all equipment per the manufacturer's recommendations and the contract drawings.

**3.02 FIELD TESTING**

- A. Provide field testing by an independent testing agency to verify that the equipment is properly assembled and installed. Repair any defects and re-test before energizing. It is intended that the equipment be fully tested so that it can be safely energized. See Testing and Startup Specification Section.
- B. Test, at least, the following according to the (NETA) Acceptance Testing Specifications:
1. Primary air switch
  2. Fuseholders
  3. Bus and termination torque throughout
  4. Transformer including insulation resistance and turns ratio test.
  5. Secondary switchboard including individual primary injection test of circuit breakers 400 amps and larger.
  6. Functional test of drawout mechanisms.
  7. Fans and Controller
  8. Verification of key interlock scheme, if used.
  9. Ground Fault Protection



10. Meter wiring, connections, and function

**END OF SECTION**



**SECTION 27 00 00**

**BASIC TELECOMMUNICATIONS REQUIREMENTS**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. This section includes general administrative and procedural requirements for the sections of Division 27, and is intended to supplement, not supersede, the requirements specified in Division 01.
- B. Related Sections
  - 1. Consult other Sections, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable installation.
  - 2. General and Supplementary Conditions and general provisions of Contract apply to Division 27 sections.
  - 3. Division 00 and Division 01 of the Project Manual apply to Division 27 sections.
  - 4. Section 27 08 00 – Telecommunications Testing
  - 5. Section 27 13 14 - Telecommunications Backbone OSP Twisted Pair Cabling
  - 6. Section 27 13 24 - Telecommunications Backbone OSP Fiber Optic Cabling
  - 7. Section 27 15 13 - Telecommunications Horizontal Twisted Pair Cabling

**1.02 REFERENCES**

- A. Reference to codes, standards, specifications and recommendations of technical societies, trade organizations and governmental agencies shall mean that latest edition of such publications adopted and published prior to submittal of the bid. Consider such codes or standards a part of this Specification as though fully repeated herein.
- B. Codes: Perform Work executed under this Section in accordance with applicable requirements of the latest edition of governing codes, rules and regulations including but not limited to the following minimum standards, whether statutory or not:
  - 1. California Code of Regulations (CCR)
    - a. Title 8, Industry Relations Chapter 3.22, California Occupational Safety and Health Regulations (CAL/OSHA)
    - b. Title 24, California Building Standards Code
      - 1) Part 2, Basic Building Regulations
      - 2) Part 3, California Electrical Code (CEC)
  - 2. National Fire Protection Agency (NFPA)
    - a. NFPA 70, “National Electrical Code” (NEC).
    - b. NFPA 75, “Protection Of Information Technology Equipment”
  - 3. National, State, Local and any other binding building and fire codes
  - 4. FCC Regulations:
    - a. Part 15 – Radio Frequency Devices & Radiation Limits

- C. Standards: Equipment and materials furnished under this Section shall conform to the following standards where applicable:
1. Underwriter's Laboratories (UL): Applicable listing and ratings, including but not limited to the following standards:
    - a. UL 444: Communications Cables
    - b. UL 497: Protectors for Paired-Conductor Communication Circuits
    - c. UL 1651: Optical Fiber Cable
  2. ANSI/TIA/EIA-568-B, "Commercial Building Telecommunications Cabling Standard"
    - a. Part 1, "General Requirements"
    - b. Part 2, "Balanced Twisted-Pair Cabling Components", including the following addenda:
      - 1) Part 2, Addendum 1, "Transmission Performance Specifications For 4-Pair 100 Ohm Category 6 Cabling"
    - c. Part 3, "Optical Fiber Cabling Components Standard"
  3. ANSI/TIA/EIA-569-B, "Commercial Building Standard for Telecommunications Pathways and Spaces", including the following addenda:
    - a. TIA/EIA-569-A-1 Surface Raceways
    - b. TIA/EIA-569-A-2 Furniture Pathways and Spaces
    - c. TIA/EIA-569-A-6 Multi-Tenant Pathways and Spaces
    - d. TIA/EIA-569-A-7 Cable Trays and Wirelines
  4. ANSI/TIA/EIA-598-B, "Optical Fiber Cable Color Coding"
  5. ANSI/TIA/EIA-606-A, "Administration Standard for the Telecommunications Infrastructure of Commercial Buildings"
  6. ANSI/J-STD-607-A, "Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications"
  7. ANSI/TIA/EIA-758, "Customer-Owner Outside Plant Telecommunications Cabling Standard"
    - a. TIA/EIA-758-1 Addendum No. 1
  8. EIA testing standards
  9. Insulated Cable Engineers Association (ICEA):
    - a. ANSI/ICEA S-83-596-1994 Fiber Optic Premises Distribution Cable
    - b. ANSI/ICEA S-87-640-1999 Fiber Optic Outside Plant Communications Cable
    - c. ANSI/ICEA S-90-661-2002 Category 3, 5, & 5e Individually Unshielded Twisted Pair Indoor Cable for Use In General Purpose and LAN Communication Wiring Systems
    - d. ICEA S-104-696-2001 Standard For Indoor-Outdoor Optical Cable
  10. Building Industry Consulting Services International (BICSI):
    - a. Telecommunications Distribution Methods Manual (TDMM)
    - b. Customer-Owner Outside Plant Design Manual
- D. Make a copy of each document readily available during the course of construction for reference by field personnel.

### **1.03 DEFINITIONS**

- A. The Definitions of Division 00 shall apply to Division 27 sections.

- B. In addition to those Definitions of Division 00, the following list of terms as used in Division 27 sections shall be defined as follows:
1. "Connect": To install required patch cords, equipment cords, cross-connect wire, etc. to complete an electrical or optical circuit.
  2. "Cabling": A combination of cables, wire, cords, and connecting hardware [e.g., cables, conductor terminations, connectors, outlets, patch panels, blocks, and labeling].
  3. "Identifier": A unique code assigned to an element of the telecommunications infrastructure that links it to its corresponding record.
  4. "Engineer" and "Engineer Of Record": TEECOM Design Group.

#### **1.04 SYSTEM DESCRIPTION**

- A. In circumstances where the specifications and drawings conflict, the most stringent requirement shall apply. Generally, the drawings shall govern quantity and the specifications shall govern quality.

#### **1.05 SUBMITTALS** Submit required submittals in accordance with Section 01 32 19.

- B. Obtain approval in writing by the Engineer for the Product Data submittals and for the Shop Drawings (as required) prior to release of order for products and equipment, and prior to installation.
- C. Product Data Submittal Requirements
1. Quantity: Submit quantity of product data submittals as described in Section 01 32 19.
  2. Format:
    - a. Product data sheets shall be 8-1/2 x 11 inch pages or 11x17 for oversized information.
    - b. Package each submittal with an outer cover. Examples include:
      - 1) 3-ring binder with front cover and spine having clear pockets for insertion of the submittal information
      - 2) 3-hole report cover with transparent front cover
    - c. Clearly label each submittal on the outer cover with the following information:
      - 1) Project name and address
      - 2) Submittal Title (e.g., "Product Data Submittal For Telecommunications Equipment Rooms")
      - 3) Project submittal number
      - 4) Specification section number/s (e.g., "Section 27 11 00").
      - 5) Date and revision; date format: <month> <day>, <year> (e.g., "January 1, 2010")
      - 6) General Contractor / Prime Builder
      - 7) Telecommunications Installer
    - d. Include index dividers for improved navigation through the submittal. Dividers shall match the Table Of Contents.
  3. Content:
    - a. Table Of Contents: Include a Table Of Contents at the beginning of submittal that lists materials by article and paragraph number (e.g., "2.02-A Equipment Racks").
    - b. Cover Letter: Include a cover letter that states the scope of the submittal and states the submittal is in full compliance with the requirements of the Contract Documents, with a specific reference that the submittal complies with Section 01 32 19 procedures. The cover letter shall be signed (and stamped, if applicable) by the person who prepared the submittal. Failure to comply with this requirement shall constitute grounds for rejection of submittal.

- c. **Product Information:** Product Data submittal shall consist of manufacturer's technical data, product literature, "catalog cuts", data sheets, specifications, and block wiring diagrams (if necessary). Also include applicable Materials Safety Data Sheet (MSDS) for each item complying with OSHA's Hazard Communication Standard 29 CFR 1910.1200. This data shall clearly describe the product's characteristics, physical and dimensional information, electrical performance data, materials used in fabrication, material color & finish, and other relevant information such as test data, typical usage examples, independent test agency information, and storage requirements. Clearly indicate by arrows or brackets precisely what is being submitted on and those optional accessories, which are included and those which are excluded. At a minimum, include products listed in the specifications numbering 27 XX XX. Also include relevant products that will be installed, which are not listed in the specifications.
- d. **Seismic Calculations:** Where required, include in the product data submittal the manufacturer's anchorage calculations for floor-mounted, fully loaded equipment racks/frames/cabinets such that it shall remain attached to the mounting surface after experiencing forces in conformance with CCR, Title 24, Table 23P, Part II and with Section 2312 "Earthquake Regulations" of the "Uniform Building Code" for Seismic Zone 4 Area, Importance Factor of 1.25. Specify proof loads for drilled-in anchors, if used. A Structural Engineer currently registered in the State of California shall prepare calculations and shall wet stamp and sign them. Forward calculations to the Owner for review and approval.
- e. **Resubmittals:** Resubmittals shall include a cover letter that lists the action taken and revisions made to each product submittal in response to Submittal Review Comments. Resubmittal packages will not be reviewed unless accompanied by this cover letter. Failure to include this cover letter will constitute rejection of the resubmittal package.

D. Shop Drawings Submittal Requirements

1. **Quantity:** Submit quantity of shop drawings as described in Section 01 32 19.
2. **Media:** Submit shop drawings on media as described in Section 01 32 19. In the absence of requirements given, submit shop drawings full size on bond or eco-bond.
3. **Format:**
  - a. Prepare shop drawings using AutoCAD 2000 or later.
  - b. Full size shall equal the Contract Documents.
  - c. Use the project title block. Insert company information in title block.
  - d. Text shall be 3/32" high, minimum, when plotted full size.
  - e. Device symbols shall match those used in the Contract Drawings.
  - f. Screen background information.
  - g. Plot system components (devices, cable routes, etc.) and text at a sufficient line weight to stand out against background information.
  - h. Label each sheet in the shop drawings set with the Specification Section Number (e.g., "27 13 10").
  - i. **Scaling:**
    - 1) Scale floor plans and reflected ceiling plans at 1/8"=1'-0".
    - 2) Scale enlarged room plans at 1/4"=1'-0".
    - 3) Scale wall elevations at 1/2"=1'-0".
    - 4) Scale rack elevations at 1"=1'-0".
4. **Content:**
  - a. Submit detailed shop drawings if the proposed installation differs from the Contract Documents or the design intent.

- b. Cover Letter: Accompany each shop drawing submittal with a cover letter stating that the shop drawings have been thoroughly reviewed by the Contractor and are in full compliance with the requirements of the Contract Documents. Cover letters shall include a drawing index, and shall be signed (and stamped, if applicable) by the person who prepared the submittal. Failure to comply with this requirement shall constitute grounds for rejection of submittal.
- c. Drawings: Shop drawing submittals shall consist of floor plans, reflected ceiling plans, enlarged room plans, wall and rack elevations, installation details, and any other aspect of the system that differs from the Contract Documents or the design intent. Scales shall be the same as the Drawings (e.g., 1/4" = 1'-0" for enlarged room plans).
- d. Seismic Calculations: As part of the shop drawings submittal, the manufacturer shall provide anchorage calculations for floor mounted fully loaded distribution frames such that it shall remain attached to the mounting surface after experiencing forces in conformance with CCR, Title 24, Table 23P, Part II and with Section 2312 "Earthquake Regulations" of the "Uniform Building Code" for Seismic Zone 4 Area, Importance Factor of 1.25. Specify proof loads for drilled-in anchors, if used. A Structural Engineer registered in the State of California shall prepare Structural Calculations, and shall wet stamp and sign them. Forward calculations to the Owner for review and approval.
- e. Resubmittals: Accompany resubmittals with a cover letter that lists the revisions made to each drawing in response to Submittal Review Comments. Resubmittals will not be reviewed unless accompanied by this cover letter. Failure to include this cover letter will constitute rejection of the resubmittal package.

E. As-Built Drawings Submittal Requirements

- 1. Quantity: Submit quantity of as-built drawings as described in Section 01 32 19.
- 2. Media: Submit shop drawings on media as described in Section 01 32 19. In the absence of requirements given, submit shop drawings full size on bond or eco-bond.
- 3. Format:
  - a. Prepare as-built drawings using AutoCAD 2000 or later.
  - b. Use the same sheet size as the Contract Documents, and use the project title block.
  - c. Text: minimum of 3/32" high when plotted at full size.
  - d. Use symbols identical to the symbols shown on the Drawings.
  - e. Screen background information.
  - f. Plot system components (devices, cable routes, etc.) and text at a sufficient line weight to stand out against background information.
- 4. Content:
  - a. As-Built Drawings shall fully represent actual installed conditions and shall incorporate revisions made during the course of construction.
  - b. Floor plans shall show:
    - 1) Locations and identifiers of outlets/devices.
    - 2) Size, quantity, location, and routes of pathways (such as cable basket, conduits, cable hangers, and other cable support devices).
  - c. Enlarged room floor plans scaled at 1/2"=1'-0" showing exact placement of equipment cabinets/frames, rack bays, and other equipment. Enlarged room overhead plans scaled at 1/2"=1'-0" showing exact placement of overhead cable support devices (e.g., cable basket, cable runway, conduit sleeves, etc.).
    - 1) Applicable rooms: Telecommunications Room
  - d. Wall elevations scaled at 1"=1'-0" showing exact placement of termination hardware (e.g., termination/cross-connect blocks).

- e. Installation details
- F. Operation and Maintenance (O & M) Manuals Submittal Requirements
- 1. Quantity: Submit quantity of O&M Manuals as described in Section 01 32 19.
  - 2. Format:
    - a. Package each O & M Manual in a white, 3-ring binder with front cover and spine having clear pockets for insertion of the project information.
    - b. Clearly label the cover of each O & M Manual with the following information:
      - 1) Client name.
      - 2) Project name and address.
      - 3) Manual title (e.g., "Operation And Maintenance Manual for Telecommunications Cabling System").
      - 4) Date; date format: <month> <day>, <year> (e.g., "January 1, 2000").
      - 5) Telecommunications Installer and General Contractor names.
    - c. Include tabbed separators for improved navigation through the manual.
  - 3. Content:
    - a. Include a Table Of Contents at the beginning that lists the contents.
    - b. 11"x17" prints of As-Built Drawings, as described above.
    - c. One CD-ROM of AutoCAD files of as-built drawings.
    - d. Manufacturer's original catalog information sheets for each component provided under applicable Section.
    - e. Warranty certificate from the manufacturer and the Contractor.
    - f. Manufacturer's instructions for system or component use.
    - g. Instructions for maintenance and warranty issues.

## 1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications
- 1. Five continuous years, minimum, design and manufacture of the materials and equipment specified herein.
  - 2. Manufacturer(s) of all products and equipment specified herein shall demonstrate that they have a quality assurance program in place to assure that all of the specifications are met. The program shall include, as a minimum, provisions for:
    - a. Incoming inspection of raw materials
    - b. In-process inspection and final inspection of the cable product
    - c. Calibration procedures of all test equipment to be used in the qualifications of the product
    - d. Recall procedures in the event that out of calibration equipment is identified.
  - 3. Conformance to certain government standards on quality assurance may be required for some applications within these specifications.
- B. Contractor Qualifications
- 1. Current, active, and valid C7 or C10 California State Contractors License. Provide a copy of Contractors License in the bid submission.
  - 2. Five, minimum, continuous years experience.
  - 3. Five, minimum, completed projects similar to scope and cost. Provide a list of projects, including references, in the bid submission.



4. Technicians qualified for the work. Provide evidence in the bid submission of Technician qualifications. Evidence shall consist of manufacturer certifications, manufacturer training, industry training, relevant project experience, etc.
  5. Also refer to individual sections within Division 27 for additional or specific requirements.
- C. Materials
1. Materials and equipment furnished shall be new, unused and without defects.
  2. Furnish only specified products and equipment, or products and equipment that have been approved in writing.
- D. Regulatory Requirements
1. Work and materials shall conform to the latest rules of National Board of Fire Underwriters wherever such standards have been established and shall conform to the regulations of the State Fire Marshal, OSHA and the codes of the governing local municipalities. Nothing in these specifications is to be construed to permit work not conforming to the most stringent of the applicable codes.
  2. Reference to codes, standards, specifications and recommendations of technical societies, trade organizations and governmental agencies shall mean that latest edition of such publications adopted and published prior to submittal of the bid. Consider such codes or standards a part of this Specification as though fully repeated herein.
  3. When codes, standards, regulations, etc. allow work of lesser quality or extent than is specified under this series of Sections, nothing in said codes shall be construed or inferred authority for reducing the quality, requirements or extent of the Drawings and Specifications. The Contract Documents address the minimum requirements for construction.
- E. Project Management and Coordination Services
1. Provide a project manager for the duration of the project to coordinate this Work with other trades. Coordination services, procedures and documentation responsibility shall include, but shall not be limited to the items listed in this section.
  2. Review of Shop Drawings Prepared by Other Subcontractors:
    - a. Obtain copies of shop drawings for equipment provided by others that require telecommunication service connections or interface with Division 26 work.
    - b. Perform a thorough review of the shop drawings to confirm compliance with the service requirements contained in the Division 26 contract documents. Document any discrepancy or deviation as follows:
      - 1) Prepare memo summarizing the discrepancy.
      - 2) Provide a copy of the specific shop drawing, indicating via cloud, the discrepancy.
    - c. Prepare and maintain a shop drawing review log indicating the following information:
      - 1) Shop drawing number and brief description of the system/material.
      - 2) Date of your review.
      - 3) Indication if follow-up coordination is required.
- F. Drawings
1. Layout: Follow the general layout shown on the Drawings except where other work may conflict with the Drawings.
  2. Accuracy: Drawings for the Work within this Division are essentially diagrammatic within the constraints of the symbology applied.

3. The Drawings do not fully represent the entire installation for the Telecommunications Cabling System. Drawings indicate the general route for the cables and the location of outlets.
4. Complete the details necessary for point-to-point design. This allows the Contractor to achieve desired results applying their own procedures and methods. Submit shop drawings for review prior to installation.

G. Role of the Engineer

1. During construction, the Engineer will work with the Contractor to provide interpretation and clarification of project contract documents, reply to (and 'process') relevant Requests for Information (RFIs), and act as an interface between the Contractor and the Owner.
2. The Owner has retained the Engineer's services to observe the Work for general compliance with the Contract Documents and to ensure that the installation meets the design intent of the system.
3. In summary, the Engineer will perform the following specific services during the construction phase:
  - a. Review product submittals and shop drawings (as required) for general compliance with the contract drawings and specifications.
  - b. Review changes as they arise, and confirm that the proposed solutions maintain the intended functionality of the system.
  - c. Observe progress of the construction, and report observations back to the Owner.
  - d. Review the testing procedures to confirm compliance with project requirements and industry-accepted practices.

**1.07 DELIVERY, STORAGE AND HANDLING**

A. Delivery

1. Products shall not be delivered to the site until protected storage space is available.
2. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at jobsite.
3. Deliver materials in manufacturer's original, unopened, undamaged packaging and containers with identification labels (name of the manufacturer, product name and number, type, grade, UL classification, etc.) intact.
4. Replace equipment damaged during shipping at no cost to the Owner.

B. Storage and Protection

1. Store materials in clean, dry, ventilated space free from temperature and humidity conditions (as recommended by manufacturer) and protected from exposure to harmful weather conditions.
2. Comply with manufacturer's requirements for each product. Comply with recommended procedures, precautions or remedies as described in the Material Safety Data Sheets (MSDS) as applicable.
3. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris, and traffic.
4. Storage outdoors covered by rainproof material is not acceptable.
5. Provide heat where required to prevent condensation or temperature related damage.

C. Handling

1. Handle in accordance with manufacturer's written instructions.
2. Damaged equipment shall not be installed.

3. Replace damaged equipment at no cost to the Owner.
4. Handle with care to prevent internal component damage, breakage, denting, and scoring.

#### **1.08 WARRANTY**

- A. Service must be rendered within 4 hours of system failure notification. Note any deviation – exceptions or improvements – to this requirement at the time of bid.
- B. Refer to Sections listed in 1.01, C for specific subsystem warranty period requirements.
- C. Manufacturers of the major system components shall maintain a replacement parts department and provide testing equipment when needed. A complete parts department or stocking distributor shall be located close enough to the job site area to supply replacement parts within a 4-hour period.
- D. Warrant installed hardware, under normal use and service, to be free from defects and faulty workmanship during the warranty period. Keep the system in operating condition at no additional material or labor costs to the Owner during the warranty period.
- E. The manufacturers shall demonstrate that a quality assurance program is in place to assure that the specifications are met. The program shall include, as a minimum, provisions for:
  1. Incoming inspection of raw materials
  2. In-process inspection and final inspection of the product
  3. Calibration procedures of test equipment to be used in the qualifications of the product
  4. Recall procedures in the event that out of calibration equipment is identified.
- F. Conformance to certain government standards on quality assurance may be required for some applications outlined in these specifications.

### **PART 2 - PRODUCTS**

#### **2.01 GENERAL**

- A. Materials used shall present no environmental or toxicological hazards as defined by current industry standards and shall comply with OSHA and EPA standards, other applicable federal, state, and local laws.
- B. Product numbers listed in Division 27 sections are subject to change by the manufacturer without notification. In the event a product number is invalid or conflicts with the written description, notify the Owner in writing prior to ordering the material and performing any installation work. Provision and installation of the approved changed product will be at no additional cost to the Owner.

#### **2.02 SUBSTITUTIONS**

- A. Requests for substitutions shall conform to the general requirements and procedure outlined in Division 01.
- B. Where items are noted as "or equal", a product of equivalent function, design, construction, quality and performance will be considered. Include in the substitution request: catalog cuts, product information, and pertinent test data required to substantiate that the product is in fact equivalent to that specified. Only one substitution will be considered for each product specified.
- C. Do not provide substitution material, processes or equipment without written authorization from the Engineer.

- D. Substitutions shall be equivalent, in the opinion of the Engineer, to the specified product. The burden of proof of such shall rest with the Contractor. When the Engineer in writing accepts a substitution, it is with the understanding that the Contractor guaranteed the substituted product, component, article, or material to be equivalent to the one specified and dimensioned to fit within the construction. Approved substitutions shall not relieve the Contractor of responsibilities for the proper execution of the work, or from any provisions of the Specifications.
- E. Manufacturers' names and model numbers used in conjunction with materials, processes or equipment included in the Contract Documents are used to establish standards of quality, utility and appearance. Materials, processes or equipment that, in the opinion of the Owner, are equivalent in quality, utility and appearance will be approved as substitutions to that specified when "or equal" follows the manufacturers' names and model number(s).
- F. Whenever any material, process or equipment is specified in accordance with a TIA/EIA specification, an ANSI specification, UL rating or other association standard, present an affidavit from the manufacturer certifying that the product complies with the particular standard specification. When requested by the Engineer, submit supporting test data to substantiate compliance at no additional cost.
- G. Pay expenses, without additional charge to the Owner, in connection with substitution materials, processes and equipment, including the effect of substitution on self, subcontractor's or other Contractor's work.

### **PART 3 - EXECUTION**

#### **3.01 EXAMINATION**

- A. Conditions: Verify conditions, provided under other sections, are acceptable for product installation in accordance with manufacturer's instructions.
- B. Pathways: Verify that pathways and supporting devices, provided under other sections, are properly and permanently installed, and that temporary supports, devices, etc., have been removed.
- C. Field Measurements: Verify dimensions of pathways, including length of pathways. For example, "true tape" the conduits to verify cabling distances.

#### **3.02 FIELD QUALITY CONTROL**

- A. Staffing: Provide a qualified foreman who is in charge of the Work and who is present at the job site at times Work is being performed. Supervise the work force executing the Work. Perform the installation within the restraints of the construction schedule.
- B. Project Management: Coordinate and attend weekly status meetings to review the overall progress and issues to be resolved throughout the course of construction. Prepare and distribute meeting agenda prior to and meeting notes after meetings in a format acceptable to the General Contractor.
- C. Scheduling: Prepare an overall construction schedule based on the results of the planning meetings with the General Contractor. Issue schedule to General Contractor for approval. Prepare and issue updated schedules whenever there are modifications.
- D. Inspection: Perform inspection after installation. Keep areas of work accessible and notify code authorities, or designated inspectors, of work completion released for inspection. Document completion, and inspection as required.

#### **3.03 INSTALLATION**

- A. Conform to applicable federal, state and local codes, and telephone standards.

- B. Coordinate the entire installation with the General Contractor, and their subcontractors, to meet the construction schedule. Include coordination meetings as required to fulfill this requirement.
- C. Related Products Installation: Refer to other sections listed in Related Sections paragraph herein for related products installation.
- D. Manufacturer's Instructions:
  - 1. Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions, and product carton instructions for installation.
  - 2. Maintain jobsite file and comply with Material Safety Data Sheets (MSDS) for each product delivered to jobsite.
- E. Adjusting:
  - 1. Make changes and revisions to the system to optimize operation for final use.
  - 2. Make changes to the system such that any defects in workmanship are corrected and cables and the associated termination hardware pass the minimum test requirements.
- F. Protection:
  - 1. Protect installed products and finish surfaces from damage during delivery and construction.
  - 2. Provide protective coverings on adjacent surfaces for protection from dust and .

### **3.04 REPAIR/RESTORATION**

- A. Replace or repair work completed by others that you deface or destroy. Pay the full cost of this repair/replacement.
- B. Paint damaged areas to existing painted surfaces caused by Work.
- C. Punch List:
  - 1. Inspect installed work in conjunction with the General Contractor and develop a punch list for items needing correction.
  - 2. Provide punch list to Owner for review prior to performing punch walk with Owner.
- D. Re-Installation:
  - 1. Make changes to adjust the system to optimum operation for final use. Make changes to the system such that any defects in workmanship are correct and cables and the associated termination hardware passes the minimum test requirements.
  - 2. Repair defects prior to system acceptance.

### **3.05 CLEANING**

- A. Clean daily. Remove temporary coverings and protection of adjacent work areas. Remove unused products, debris, spills, or other excess materials. Remove installation equipment.
- B. Leave finished work and adjacent surfaces in neat, clean condition with no evidence of damage.
- C. Repair or replace damaged installed products.
- D. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance. Legally dispose of debris.

**3.06 DEMONSTRATION**

- A. On completion of the acceptance test, schedule a time convenient with the Owner or Owner's Representative for instruction in the configuration, operation, and maintenance of the system.
- B. Provide 4 hours, minimum, of on-site orientation and training by a factory-trained representative. Document dates and times of training, and submit a "sign in" sheet for individuals trained, as part of the close out documentation.

**3.07 CERTIFICATION**

- A. Provide to Owner or Owner's Representative a written form of acceptance for signature. Corrections must be completed before Owner or Owner's Representative and Engineer will give acceptance.

**END OF SECTION**

**SECTION 27 08 00**

**TELECOMMUNICATIONS TESTING**

**PART 1 - GENERAL**

**1.01 SCOPE OF WORK**

- A. Section Includes: Testing of Telecommunications Backbone and Horizontal Cabling subsystems.
- B. Related Sections
  - 1. Consult all other Sections and Divisions, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to completely test a complete and operable system.
  - 2. Section 27 00 00 – Basic Telecommunications Requirements
  - 3. Section 27 13 14 – Telecommunications Backbone OSP Twisted Pair Cabling
  - 4. Section 27 13 24 – Telecommunications Backbone OSP Fiber Optic Cabling
  - 5. Section 27 15 13 - Telecommunications Horizontal Cabling
- C. Products Furnished and Installed Under Other Sections:
  - 1. Telecommunications Cabling

**1.02 REFERENCES**

- A. Comply with Section 27 00 00 References requirements.
- B. Additional references to those listed in Section 27 00 00.
  - 1. TIA/EIA-526-7 (“OFSTP-7”) Measurement of Optical Power Loss of Installed Singlemode Fiber Cable Plant
  - 2. TIA/EIA-455-171 Attenuation By Substitution Measurement – For Short-Length Multimode Graded-Index And Single-Mode Optical Fiber Cable Assemblies (a.k.a., FOTP-171)

**1.03 DEFINITIONS**

- A. Refer to Definitions of Sections 27 00 00, 27 15 13, 27 13 14, and 27 13 24.
- B. In addition, the following list of terms as used in this specification shall be defined as follows:
  - 1. “Adapter” (associated with fiber connectivity): Shall mean a connecting device joining 2 fiber connectors, either like or unlike.
  - 2. “Channel”: Shall mean a testing configuration which includes the Permanent Link and the line cord (at the workstation), the equipment cord, and, if a full crossconnection is implemented, a patch cord and the crossconnect termination/connecting apparatus.
  - 3. “Connect”: Shall mean install all required patch cords, equipment cords, cross-connect wire, etc. to complete an electrical or optical circuit.
  - 4. “Cord”: Shall mean a length of cordage having connectors at each end. The term “Cord” shall be synonymous with the term “Jumper”. The cord may be:
    - a. Unshielded twisted pair

- b. Fiber (multimode or singlemode), jacketed & buffered
- 5. "Launch Cord": Shall mean the cord certified for use in fiber optic characterization testing, as described in this section.
- 6. "OTDR": Shall mean Optical Time Domain Reflectometer.
- 7. "Passive Link Segment": Shall mean the cable, connectors, couplings, and splices between two fiber optic termination units.
- 8. "Permanent Link": Shall mean the 'permanent' portion of the Horizontal cabling to each outlet with the test cords de-embedded from the measurements; this includes cable, consolidation point (if used), termination/connecting apparatus in the IDF and the connector at the outlet.
- 9. "System Cord": Shall mean the cord used in the operating electrical or optical circuit.
- 10. "Test Cord": Shall mean the cord certified for use in testing, as described in this section.

**1.04 SYSTEM DESCRIPTION**

A. Work Provided Under Other Sections

- 1. Refer to Sections 27 13 14, 27 13 24, and 27 15 13 for additional system descriptions.
- 2. Backbone Cabling
  - a. The Backbone Cabling includes twisted pair and fiber cabling.
- 3. Horizontal Cabling
  - a. The Horizontal Cabling, in general, consists of multiple 4-pair Category 6 UTP cables to each outlet. Refer to the Drawings for specific requirements.

B. Base Bid Work

- 1. Testing of a completed Telecommunications Cabling System, including:
  - a. Procedures Submittals
  - b. Equipment Submittals
- 2. Testing Requirements:
  - a. Fiber optic passive link segment(s):

**Table 270800-1.1: Tests For Fiber Optic Passive Link Segments**

Subsystem	Type	Test	Direction	Wavelength
Backbone	Singlemode	Characterization	Both	1310nm and 1550nm
Backbone	Singlemode	Passive Link Ins. Loss	One	1310nm and 1550nm

- b. Multipair/UTP cabling:

**Table 270800-1.2: Tests For Multipair/UTP Cabling**

Subsystem	Type	Test	Configuration	Notes
Backbone	Riser	Wire map & length	-	-
Horizontal	CAT6	Category 6	Permanent Link	Per TIA/EIA-568-B.2-1

- c. Record Documents, including test reports.

**1.05 SUBMITTALS**

- A. Refer to Submittals of to Section 27 00 00 for procedural, quantity, and format requirements.



**B. Preconstruction Submittal Requirements:**

1. Testing Procedures Submittal, describing step-by-step procedures used by the field technicians.
2. Product Submittal, including cut sheets of testing equipment to be used (note all software/firmware versions as applicable) and certificate of last calibration.
3. Schedule Submittal, consisting of proposed schedule of work. This schedule may be combined with the schedule developed for 27 XX XX series Sections.

**C. Submittal Requirements at Closeout:**

1. Record Documents

**D. Submittal Description: Record Documents**

1. Test Reports: Record documents submittal shall include test reports showing the following information:
  - a. A title page which includes:
    - 1) Client Name
    - 2) Project Name
    - 3) Project Address
    - 4) General Contractor name / Telecommunications Installer name
    - 5) Date of Submittal
  - b. Individual tabs which break down the test results by building, and then by telecommunications room.
  - c. All Backbone Fiber Optic "Post Installation" Passive Link Attenuation test results (utilize the forms provided in Part 4 of this specification for documentation of test results if the tester used does not have data storage capabilities) and Fiber Optic OTDR test results.
  - d. All Backbone UTP test results
  - e. All Horizontal cable test results, per cable
2. Furnish all test results on CD-ROM in their native data format and an exported Microsoft Excel compatible format.
  - a. Include all necessary software to allow viewing and printing of individual test results.
  - b. CD shall be labeled with the project name, contractor name, and date of submission.

**1.06 QUALITY ASSURANCE**

- A. Comply with the Quality Assurance requirements of Section 27 00 00.

**1.07 WARRANTY**

- A. Warrant the validity of the test results. Under no circumstances shall any cable's test results be substituted for another's. If a single instance of falsification is confirmed, the Contractor shall be liable for a complete retest of the cabling system at no impact to cost and schedule. This includes the retaining the services of a neutral party to observe all retesting.

**PART 2 - PRODUCTS**

**2.01 GENERAL**

- A. The manufacturer may change the product numbers listed in this Section at any time, as well as software and firmware versions. In the event this Section contains an invalid product number or

conflicts with the written description, or specifies an out-of-date software and/or firmware version, notify the Engineer in writing prior to issuing submittals or field testing.

## 2.02 FIBER OPTIC LIGHT SOURCE

- A. All connection interfaces shall be factory installed. No field-configurable adapters will be allowed at the light source.
- B. Wavelengths output shall be continuous.
- C. LASER-based light source for singlemode fiber testing shall have a:
  - 1. Center wavelength of  $1310\text{n} \pm 20\text{nm}$  and  $1550\text{n} \pm 20\text{nm}$ .
  - 2. Spectral width (FWHM) of  $\leq 5\text{nm}$  at  $1310\text{nm}$  and  $\leq 5\text{nm}$  at  $1550\text{nm}$ .
  - 3. Minimum output power level of  $\geq 3\text{dBm}$ .
- D. The light sources may contain internal lenses, pigtails, and modal conditioners, provided they meet the launch conditions as described in "Post-Installation" Passive Link Attenuation Testing Procedures (ref. PART 3 - EXECUTION).
- E. Equipment shall be factory-calibrated within 12 months of testing date.
- F. Equipment:
  - 1. Corning Cable Systems
    - a. #OS-301 light source
    - b. #OS-302 light source
    - c. #OS-100D light source
  - 2. Fluke Networks' DSP-4300 test set
    - a. #DSP-4300; "CableAnalyzer" test kit, loaded with most current firmware version
    - b. #DSP-FTA430S; 'Singlemode' fiber testing adapter, LASER-based ( $1310\text{nm}$ ,  $1550\text{nm}$ )
    - c. LinkWare; "LinkWare" management software (latest version)

## 2.03 FIBER OPTIC POWER METER

- A. The power meter for both multimode and singlemode testing must be capable of measuring relative or absolute power, and must be independent of modal distributions.
- B. All power meters used must be calibrated and traceable to the National Bureau of Standards.
- C. All power meters used shall have the following performance:
  - 1. Dynamic range of  $0\text{dBm}$  to  $-40\text{dBm}$ , minimum.
  - 2. Accuracy of  $\pm 0.2\text{dB}$ .
- D. Equipment shall be factory-calibrated within 12 months of testing date.
- E. Equipment:
  - 1. Corning Cable Systems,
    - a. #OTS-210 power meter, with data storage capacity
    - b. #OTS-310 power meter, with data storage capacity
  - 2. Fluke Networks' DSP-4300 test set
    - a. #DSP-4300; "CableAnalyzer" test kit, loaded with most current firmware version

- b. #DSP-FTA430S; ‘Singlemode’ fiber testing adapter, LASER-based (1310nm, 1550nm)
- c. LinkWare; “LinkWare” management software (latest version)

**2.04 FIBER OPTIC OTDR**

A. Singlemode Source Module:

Wavelength	Dynamic Range	Attenuation Deadzone	Reflective Deadzone	Loss Resolution	Distance Accuracy
1310nm	40dB	6.0mt	3.5mt	0.001dB	0.1mt
1550nm	28dB	12.0mt	3.5mt	0.001dB	0.1mt

B. Equipment, including main unit and source modules, shall be factory-calibrated within 12 months of testing date.

C. Equipment:

- 1. Agilent Technologies #8147, for multimode & singlemode systems
- 2. Corning Cable Systems
  - a. 2001HR, for multimode & singlemode systems
  - b. 340 OTDR Plus Multitester II
  - c. MiniOTDR+, for multimode & singlemode systems
- 3. Tektronix
  - a. TFP2A FiberMaster
  - b. TFS3031 TekRanger2

**2.05 FIBER OPTIC TEST CORDS**

A. Singlemode Fiber Optic Test Cord

- 1. The fiber of the singlemode test cord(s) shall have the mode field diameter nominally equal to that of the singlemode fiber optic passive link.
- 2. The length of test cords used for insertion loss testing shall be between 1m and 5m.
- 3. The connectors of the test cords shall be compatible with the connector types of the light source and the power meter.
  - a. The connector of the test cords shall be that which the light source accepts.
- 4. The connectors shall exhibit  $\leq 0.5$ dB loss per connection @ both 1300nm and 1550nm, as measured per FOTP-171 D3.
- 5. All singlemode connectors shall inhibit Fresnel reflections (i.e., have a “PC” finish).

**2.06 CATEGORY 6 HORIZONTAL CABLE TESTER**

- A. Equipment shall meet TIA/EIA-568B.2 Addendum 1 requirements for Level III accuracy.
- B. Test Standards (minimum): TIA Category 6 (per TIA/EIA-568B.2 Addendum 1); ISO/IEC 11801 Class C and D; ISO/IEC 11801-2000 Class C and D, 1000Base-T, 100Base-TX; IEEE 802.3 10Base-T; ANSI TP-PMD; IEEE 802.5
- C. Areas of Test Measurement (minimum): Wire Map; Length; Insertion Loss; Near End Crosstalk (NEXT) loss, at both master unit and remote unit; Power Sum NEXT (PSNEXT) loss, at both master unit and remote unit; Equal Level Far End Crosstalk (ELFEXT), at both master unit and remote unit;

Power Sum ELFEXT, at both master unit and remote unit; Return Loss (RL), at both master unit and remote unit; Propagation Delay and Delay Skew; Attenuation-to-Crosstalk Ratio (ACR), at both master unit and remote unit; Power Sum ACR (PSACR), at both master unit and remote unit; Characteristic Impedance; DC Loop Resistance.

D. Equipment: Agilent Technologies

1. #N2600A-100; "WireScope 350" test kit (main unit, remote unit, CAT6 permanent link probe, CAT6 channel probe, accessories), loaded with most current firmware version
2. "ScopeData Pro" reporting and documentation software latest version

E. Equipment: Fluke Networks

1. #DTX-1200 or #DTX-1800; "DTX CableAnalyzer" test kit (main unit, remote unit, CAT6 permanent link adapters, CAT6 channel adapters, accessories), loaded with latest version of firmware.
2. #DSP-4300; "CableAnalyzer" test kit (main unit, remote unit, CAT6 permanent link adapters, CAT6 channel adapters, accessories), loaded with most current firmware version
3. "LinkWare" reporting and documentation software latest version

**2.07 BACKBONE UTP CABLING TESTERS**

A. Wire Map (continuity, opens, shorts, crossed pairs, split pairs) tester, or equal:

1. Siemon #MT-5000 test unit, with 25-pair adapter

B. Length tester, or equal:

1. Harris #TS-90 test unit

**PART 3 - EXECUTION**

**3.01 SCHEDULING**

- A. Prepare a schedule for testing activities based on the schedule developed for Sections 27 13 14, 27 13 24, and 27 15 13. Update testing schedule when changes in the cabling construction schedule occur.
- B. Schedule both the Engineer of Record and a representative of the test equipment manufacturer for a demonstration of testing methods. Execute a demonstration of testing methods with aforementioned parties prior to 'production' testing activities. Test reports and acceptance testing will not be accepted without proof of methods demonstration.

**3.02 FIELD QUALITY CONTROL**

- A. Complete testing as delineated below prior to system acceptance.
- B. Permanently record all test results and presented in a format acceptable to the Owner or Engineer before system acceptance.
- C. Remove and replace with new, at no cost to the Owner, any cables or conductors (copper or glass) failing to meet the indicated standards. The Owner will not accept the installation until testing has indicated a 100% availability of all cables and conductors or the Owner has approved any deviation from this requirement.

- D. Calibrate test sets and associated equipment per the manufacturers printed instructions at the beginning of each day's testing and after each battery charge. Fully charge the test sets prior to each day's testing to ensure proper operation.

**3.03 "PRE-INSTALLATION" CONTINUITY TESTING PROCEDURES**

- A. Ensure fiber continuity of all fiber strands of all cables prior to installation.
- B. Reports from "pre-installation" continuity testing are not required to be submitted at project close out.

**3.04 BACKBONE FIBER OPTIC CHARACTERIZATION TESTING**

- A. Test fiber optic passive links per "Base Bid Requirements" in Part 1 of this Section.
- B. Precautions
  - 1. Adhere to the equipment manufacturer's instructions during testing activities.
  - 2. Prior to any testing activity or any measurements taken, complete the following activities:
    - a. Ensure the test equipment is at room temperature – approximately 70 degrees F (e.g., if necessary, bring the test equipment in from outdoors and let it set for however long it takes to bring the test equipment to reach room temp).
    - b. Clean all launch cords and system cords (if applicable) connectors and all adapters with a lint-free wipe and 90% (or higher) isopropyl alcohol.
  - 3. Do not power off OTDR's light source during testing activity.
  - 4. Do not remove launch cord from the OTDR's light source at any time (unless the testing is complete or the equipment is being put away for the evening, or during trouble shooting).
  - 5. Do not bend the launch cord smaller than 20 times the cord diameter during testing activities (this may induce loss into the cord reducing the accuracy of the measurement).
  - 6. Fully charge power source before each day's testing activity, if applicable.
- C. "Post-Installation" Characterization Testing Procedures
  - 1. Equipment settings / measurement parameters:
    - a. Index of Refraction: match cable-under-test fiber parameters; default settings as follows:

Singlemode	Corning SMF-28	1.4675 @ 1310nm	1.4681 @ 1550nm
	OFS	1.466 @ 1310nm	1.467 @ 1550nm
    - b. Pulse Width: 10 ns.
    - c. Backscatter: -74dB @ 1310nm and 1550nm
    - d. Event Threshold: 0.05dB
    - e. Reflection Threshold: -60dB
    - f. Fiber Break/End-Of-Fiber: 3dB
  - 2. Waveform: The waveform shall be real-time/normal density.
  - 3. Obtain measurements using a 'launch' cord connected to the test instrument and the cable-under-test.
    - a. The fiber of the launch cord shall match the fiber of the cable-under-test in physical and performance parameters (such as type, core/cladding size, index of refraction, refractive profile). The fiber of the launch cord should match the fiber of the cable-under-test in manufacturer and product.
    - b. The length of the launch cord shall be between 25 meters and 100 meters.

4. Review the results of each test and bring to the attention of the Engineer all fibers that do not meet the manufacturer's allowed loss for splices and connectors, or fibers that do not meet the length of the overall cable length.

D. Record Documents:

1. Test reports shall match the cable and fiber IDs as labeled in the field – i.e., the ID on the cable label/fiber port label shall be the same as what is associated with the electronic and printed test record.
2. The units for distance measurements (i.e., the “X” axis of the graph) shown on the print of the test measurements shall be feet.
3. For the traces, the x- and y-axis scales of a given cabling link shall be identical. Preferably, all reports shall be printed with identical scales on both x- and y-axis.
4. The launch cord must be shown in the trace of the printed test report.
5. Measurements shall carry a precision through one significant decimal place (minimum).
6. Each test report shall contain the following information (not necessarily in this order):
  - a. Project name,
  - b. General Contractor name / Telecommunications Installer name
  - c. Cable identifier, fiber number, and fiber type (e.g., “multimode”)
  - d. Measurement direction,
  - e. Date measurement was obtained,
  - f. Operator (name an company),
  - g. Test equipment model and serial number(s),
  - h. Set up parameters (minimum - pulse width, refractive index, event threshold.)
  - i. Wavelength,
  - j. OTDR trace,
  - k. Length of fiber,
  - l. Overall link loss.
7. For each passive cabling link, include either a schematic graphic or narrative accurately describing the test set up as a preface to the test reports. In other words, show the launch cord with length, expected events with distances, etc. This information will eliminate many questions the Engineer will have while reviewing the reports.

**3.05 BACKBONE FIBER OPTIC PASSIVE LINK INSERTION LOSS TESTING**

- A. Test fiber optic passive links per “Base Bid Requirements” in Part 1 of this Section.
- B. Launch Conditions:
  1. For passive link insertion loss testing for multimode fibers, the modal launch condition from the light source shall be characterized as Category 1 per OFSTP-14.
  2. For passive link insertion loss testing of singlemode fibers:
    - a. Use the launch conditions, as described in FOTP-78.
    - b. Employ a method to remove high-order propagating modes, as described in FOTP-77.
- C. Test Methods:
  1. The passive link insertion loss testing of singlemode fibers shall be performed according to “Test Method A.1: One Jumper Measurement”, per OFSTP-7.

D. Precautions

1. Adhere to the equipment manufacturer's instructions during testing activities.
2. Prior to any testing activity or any measurements taken:
  - a. Ensure the test equipment is at room temperature – approximately 70 degrees F (e.g., if necessary, bring the test equipment in from outdoors and let it set for about 15 minutes or for however long it takes to bring the test equipment to reach room temp).
  - b. Power on the light source and power meter for at least 5 minutes.
  - c. Clean all test cords & system cords (if applicable) connectors and all adapters with a lint-free wipe and 90% (or higher) isopropyl alcohol.
3. Do not power off light source or the power meter during testing activity.
4. Do not remove Test Cord #1 from the light source at any time (unless the testing is complete or the equipment is being put away for the evening).
5. Do not bend the test cords smaller than 20 times the cord diameter (this may induce loss into the cord reducing the accuracy of the measurement).
6. Fully charge power sources before each day's testing activity.

E. Passive Link Insertion Loss Testing Procedures

1. Test Equipment Set Up
  - a. Follow the test equipment manufacturer's initial adjustment and set up instructions.
  - b. If the power meter has a Relative Power Measurement Mode, select this mode.
  - c. If the meter can display power levels in dBm, select this unit of measurement to simplify subsequent calculations.
  - d. Set the light source and power meter to the same wavelength.
2. Test Cord Performance Verification
  - a. Connect Test Cord #1 between the light source and the power meter.
  - b. The value displayed on the power meter is the reference power ( $P_{ref}$ ) measurement. If the power meter has a relative power measurement mode, enter this reference power measurement ( $P_{ref}$ ) value into the meter. If it does not, hand-write  $P_{ref}$  onto the record documents for future reference.
  - c. Disconnect Test Cord #1 from the power meter. Do not disconnect Test Cord #1 from the light source.
  - d. Connect the 'open' end of Test Cord #1 to an adapter (of matching connector type). Connect one end of Test Cord #2 to the adapter and the other end of Test Cord #2 to the power meter.
  - e. The value displayed on the power meter is the power measurement ( $P_{sum}$ ). If the power meter is in Relative Power Measurement Mode, the meter reading represents the test cord #2 connection attenuation. If the meter does not have a Relative Power Measurement Mode, perform the following calculation to determine the connection attenuation:
    - 1) If  $P_{sum}$  and  $P_{ref}$  are in the same logarithmic units (dBm, dBu, etc): Connection Attenuation (dB) =  $|P_{sum} - P_{ref}|$
    - 2) If  $P_{sum}$  and  $P_{ref}$  are in watts: Connection Attenuation (dB) =  $|10 \times \log_{10} [P_{sum}/P_{ref}]|$ .
    - 3) The measured connection attenuation must be less than or equal to the value found in Table 3 (below).
  - f. Flip the ends of Test Cord #2 so that the end connected to the power meter is now connected to the adapter, and the end connected to the adapter is now connected to the power meter.

- g. The meter reading is the reversed Power Measurement ( $P_{sum}$ ). Perform the proper calculations if not using Relative Power Measurement Mode.
- h. Verify that both connection attenuation measurements are less than or equal to the value found in the following table:

	ST or SC Cord	Mini-Connector Cord
Singlemode	0.55 dB Max	0.30 dB Max

- i. If both measurements are found to be less than or equal to the values found in Table 1, test cord #1 is acceptable for testing purposes. Unacceptable attenuation measurements may be attributable to test cord # or test cord #2. Examine each cord with a portable microscope and clean, polish, or replace if necessary.
  - j. Repeat this test procedure from the beginning reversing the test cords in order to verify the performance of test cord #2.
3. Singlemode Insertion Loss Measurement
- a. After setting up the test equipment and verifying the performance of the test cords, the insertion loss of the passive link segments can be measured.
  - b. Connect test cord #1 between the light source and the power meter.
  - c. The meter reading is the Reference Power Measurement ( $P_{ref}$ ). If the power meter has a Relative Power Measurement Mode, enter the Reference Power Measurement ( $P_{ref}$ ) value into the meter. If it does not, hand-write  $P_{ref}$  for future reference and to be included in the Record Documents.
  - d. Disconnect test cord #1 from the power meter. Do not disconnect test cord #1 from the light source.
  - e. Connect test cord #1 to the passive link segment 'input'.
  - f. At the opposite end of the passive link segment, connect test cord #2 to the link segment 'input' and the power meter.
  - g. The meter reading is the Power Measurement ( $P_{sum}$ ). If the power meter is in Relative Power Measurement Mode, the meter reading represents the insertion loss. If the meter does not have a Relative Power Measurement Mode, perform the following calculation to determine the insertion loss:
    - 1) If  $P_{sum}$  and  $P_{ref}$  are in the same logarithmic units (dBm, dBu, etc): Link Segment Attenuation (dB) =  $| P_{sum} - P_{ref} |$
    - 2) If  $P_{sum}$  and  $P_{ref}$  are in watts: Link Segment Attenuation (dB) =  $| 10 \times \log_{10} [P_{sum}/P_{ref}] |$
  - h. Record  $P_{sum}$  for inclusion into the Record Documents. Refer to Records (ref. PART 3: EXECUTION) for all of the information to record.
4. Acceptable Measurement Values
- a. Any cabling links failing to meet the criteria described in this specification shall be removed and replaced, at no cost to the Owner, with cables that prove, in testing, to meet the minimum requirements.
  - b. The general insertion loss equation for any link segment is as follows:
    - 1) Insertion loss = <cable loss> + <connection loss> + <splice loss> + <CPR adjustment>.
    - 2) Note: A connection is defined as the joint made by two mating fibers terminated with remateable connectors (e.g., ST, SC, etc).
  - c. Singlemode Insertion Loss Coefficients
    - 1) Cable Loss = Cable Length (km) x (0.50 dB/km @ 1310-nm or 0.50 dB/km @ 1550-nm)
    - 2) Connection Loss (ST or SC Connectors) = (Connections x 0.44 dB) + 0.42 dB



- 3) Connection Loss (Other mini-connectors) = (Connections x 0.24 dB) + 0.24 dB
- 4) Splice Loss = Splices x (0.07 dB for fusion or 0.15 dB for mechanical)
- 5) CPR Adjustment = Not applicable for singlemode.

F. Record Documents:

1. All cable and fiber IDs of the test reports shall match the IDs as labeled in the field – i.e., the ID on the cable label/fiber port label shall be the same as what is entered into the stored test result in the power meter.
2. Measurements shall carry a precision through one significant decimal place (minimum).
3. Each test report shall contain the following information (not necessarily in this order):
  - a. Project name and address,
  - b. General Contractor name / Telecommunications Installer name.
  - c. Operator's name(s),
  - d. Date of measurement,
  - e. Test equipment - manufacturer, model, and serial number,
  - f. Cable identifier, fiber and fiber type,
  - g. Measurement direction,
  - h. Wavelength, and
  - i. Measured loss values.

**3.06 BACKBONE TWISTED PAIR CABLING TESTING REQUIREMENTS AND PROCEDURES**

A. Testing Requirements

1. Test backbone multipair cabling per “Base Bid Requirements” in Part 1 of this Section.
2. The installation will be accepted when testing has indicated a 100% availability of all terminated pairs or the Owner has approved any deviation from this requirement.

B. Testing Procedures

1. Test wire map and continuity for all pairs.
2. Test length for 2% of pairs of each cable. None of the pairs tested for length shall be of the same 25-pair binder group.

C. Record Documents:

1. All cable and pair IDs of the test reports shall match the IDs as labeled in the field – i.e., the ID on the cable label/termination label shall be the same as what appears on the test reports.
2. Measurements shall carry a precision through no significant decimal place.
3. Each test report shall contain the following information (not necessarily in this order):
  - a. Project name and address,
  - b. General Contractor name / Telecommunications Installer name,
  - c. Operator's name(s),
  - d. Date of measurement,
  - e. Test equipment - manufacturer, model, and serial number,
  - f. Cable identifier and pair numbers,
  - g. Overall test result, and
  - h. Measured values of minimum requirements.

**3.07 HORIZONTAL CATEGORY 6 TESTING PROCEDURES**

A. Precautions

1. Adhere to the equipment manufacturer’s instructions during all testing.
2. Prior to any testing activity or any measurements taken, ensure the test equipment is at room temperature – approximately 70 degrees F (e.g., if necessary, bring the test equipment in from outdoors and let it set for about 15 minutes or for however long it takes to bring the test equipment to reach room temp).
3. Fully charge power sources before each day’s testing activity

B. Test Equipment Set Up

1. Set up the tester to perform a full Category 6 test, as a Permanent Link configuration.
2. If the tester has the capability, set the cable type as product specific setting. If not, set as generic Category 6.
3. Set the tester to save the full test results (all test points, graphs, etc.).
4. Save the test results with the associated cable link identifier to match that as specified in Section 27 15 13.
5. Calibrate the test set per the manufacturers instructions.

C. Acceptable Test Result Measurements

1. Links which report a Fail, Fail\* or Pass\* for any of the individual tests shall result in an overall link Fail. All individual test results must result in a Pass to achieve an overall Pass.
2. Any reconfiguration of link components required as a result of a test Fail, must be re-tested for conformance.
3. Any cabling links failing to meet the criteria described in this specification shall be removed and replaced, at no cost to the Owner, with cables that prove, in testing, to meet the minimum requirements.
4. Minimum measurement requirements:

Wire Map	All pairs of the cabling link shall be continuous and terminated correctly at both ends. No exceptions shall be accepted.
Length	The maximum acceptable electrical length measurements for any cabling link measured under a Permanent Link configuration shall be 94 meters, including test cords.
Insertion Loss	The acceptable insertion loss measurements for any Category 6 cabling link shall be no greater than that as listed in TIA/EIA-568B.2 Addendum 1.
Worst Pair-to-Pair Near End CrossTalk (NEXT) Loss	The acceptable worst pair-to-pair NEXT loss for any Category 6 cable shall be no greater than that as listed in TIA/EIA-568B.2 Addendum 1.
Power Sum NEXT Loss	The acceptable power sum PS-NEXT loss for any Category 6 cable shall be no greater than that as listed in TIA/EIA-568B.2 Addendum 1.
Worst Pair-to-Pair ELFEXT and FEXT Loss	The acceptable worst pair-to-pair ELFEXT and loss for any Category 6 cable shall be no greater than that as listed in TIA/EIA-568B.2 Addendum 1.

Power Sum ELFEXT and FEXT Loss	The acceptable PS-ELFEXT and loss for any Category 6 cable shall be no greater than that as listed in TIA/EIA-568B.2 Addendum 1.
Return Loss	The acceptable return loss measurements for any Category 6 cable shall be no greater than that as listed in TIA/EIA-568B.2 Addendum 1.
Propagation Delay and Delay Skew	The acceptable propagation delay and delay skew measurements for any Category 6 cable shall be no greater than that as listed in TIA/EIA-568B.2 Addendum 1.

D. Record Documents

1. For each Horizontal Category 6 test measurement, record the following information:
  - a. Project name and address,
  - b. General Contractor name / Telecommunications Installer name,
  - c. Operator's name(s),
  - d. Date of measurement,
  - e. Ambient temperature,
  - f. Test equipment - manufacturer, model, and serial number,
  - g. Cable identifier,
  - h. Overall test result, and
  - i. Measured values of minimum requirements.

**END OF SECTION**



**SECTION 27 13 14**

**TELECOMMUNICATIONS BACKBONE OSP TWISTED PAIR CABLING**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section includes: Backbone outside plant (OSP) twisted pair cabling.
- B. Related Sections
  - 1. Comply with the Related Sections paragraph of Section 27 00 00.
  - 2. Section 27 08 00 - Telecommunications Testing
- C. Products Furnished and Installed Under Another Section:
  - 1. Conduits, pullboxes, and other underground pathways.

**1.02 REFERENCES**

- A. Comply with the References requirements of Section 27 00 00.

**1.03 DEFINITIONS**

- A. Refer to Division 01 for Definitions.
- B. In addition, the following list of terms as used in this specification shall be defined as follows:
  - 1. "BEP": Building Entrance Protection [systems]
  - 2. "CMP": Communications Media Plenum [NEC plenum rating]
  - 3. "CMR": Communications Media Riser [NEC riser/non-plenum rating]
  - 4. "HDPE": High Density Polyethylene
  - 5. "ISP": Inside Plant [cabling]
  - 6. "LDPE": Light Density Polyethylene
  - 7. "OSP": Outside Plant [cabling]
  - 8. "PE": Polyethylene
  - 9. "PIC": Plastic Insulated Conductor
  - 10. "PVC": Polyvinyl Chloride

**1.04 SYSTEM DESCRIPTION**

- A. Work
  - 1. Work includes engineering, labor, materials, apparatus, tools, equipment, and transportation required to make a complete working telecom backbone twisted pair cabling system installation described in these specifications.
  - 2. Cabling, including terminations at both ends, shown on Drawings shall be considered as base bid work, unless otherwise noted.

3. The Drawings are diagrammatic in nature.
4. In general, the work includes:
  - a. Preconstruction Submittals
  - b. Backbone outside plant (interbuilding) twisted pair (copper) cables and terminations
  - c. Building entrance protection and terminals
  - d. Splicing apparatus, as specified
  - e. Cable management
  - f. Cable identification tags and system labeling
  - g. Record Documents
  - h. Warranty

#### **1.05 SUBMITTALS**

- A. Comply with Division 01 for procedural, quantity, and format requirements.
- B. Preconstruction Submittal Requirements:
  1. Product Data Submittal, indicating conformance with NEC, UL, TIA/EIA listings, certifications and specifications.
  2. Schedule Submittal, consisting of proposed schedule of work
  3. Shop Drawings Submittal, consisting of proposed changes to cable routing, or termination locations/configurations
- C. Closeout Submittal Requirements:
  1. As-Built Drawings
  2. O & M Manuals

#### **1.06 QUALITY ASSURANCE**

- A. Comply with Division 01 Quality Assurance requirements.
- B. Contractor Qualifications
  1. In addition to the Contractor Qualifications requirements of Division 01, the Contractor shall be manufacturer certified to install the proposed and submitted cabling system and to provide an extended warranty. Provide satisfactory evidence of certification in the form of a current letter or certificate from the manufacturer as part of the bid submission.

#### **1.07 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Comply with Division 01 Delivery, Storage and Handling requirements.

#### **1.08 WARRANTY**

- A. The OSP cabling shall be warranted under the minimum Project warranty. Refer to Division 01 for requirements.

## **PART 2 - PRODUCTS**

### **2.01 UNDERGROUND CABLES**

#### **A. Application:**

1. Cable shall be suitable for outdoor installations, within underground conduit.
2. Cable shall be twisted pair PIC type cable, filled core, with an "ASP" sheath. Cable shall be compatible with Bell System type "ANMW".

#### **B. Conductors:**

1. Conductors shall be 24 AWG annealed solid copper.
2. Conductors shall be fully insulated. Insulation shall consist of an inner layer of expanded PE, covered with an outer layer (skin) of solid PE.
3. Conductors shall be twisted into pairs. Twisted pairs are stranded into 25-pair bundles and into units (and super units, if required by pair count).
4. Color Coding: Twisted pairs and units (super units, if necessary) shall be individually color coded to industry standards (ANSI/ICEA Publication S-80-576, and EIA-230).

#### **C. Core & Sheath:**

1. Cable core (twisted pairs) shall have a tape applied longitudinally (wrapped around it's entirety). Tape Material: non-hydroscopic polypropylene film, or equivalent.
2. Filled: Cable core and sheath shall be flooded with filling compound to protect against moisture penetration. Filling compound: "FLEXGEL", or equivalent.
3. Sheath Type: "ASP". Sheath shall consist of a shield and an outer jacket.
  - a. Shield: Dual corrugated tape of inner aluminum and outer steel longitudinally applied, with a locking overlap.
  - b. Jacket: PE, bonded to shield.

#### **D. Manufacturer:**

1. General "Filled Foam Skin ASP (Spec 2100)" series cables
2. Superior Essex "Filled ASP ANMW" series cables

### **2.02 SPLICE CLOSURES AND ACCESSORIES**

#### **A. Splice Closure – Underground Vault Type**

1. Application: Splice closure system shall be suitable for outdoor installation within underground vault and/or maintenance hole.
2. Enclosure:
  - a. Enclosure shall be re-enterable.
  - b. Through-splice or butt-splice configurations will be accepted.
  - c. Size enclosure based on splice bundle diameter and largest incoming cable.
  - d. End caps shall accept one cable per end / one incoming cable and two outgoing cables.
3. Manufacturer: 3M Telcom, or equal:
  - a. #50BA3P-510
  - b. #4460-D; shield bond connector for cables 100-pair or smaller
  - c. #25T Ground Braid or #25T Ground Braid with Eyelets

**B. Splice Closure – Building Entrance Type**

1. Application: Splice closure system shall be suitable for indoor installation within entrance facilities for splicing between OSP and ISP cable.
2. Closure:
  - a. Enclosure shall be re-enterable.
  - b. Through-splice or butt-splice configurations will be accepted.
  - c. Sleeve shall be solid / Solid or split sleeve will be accepted.
  - d. Size enclosure based on splice bundle diameter and largest incoming cable.
  - e. End caps shall accept eight single collared or shall have multiple holes.
3. Include all required accessories, such as collars, grommets, bushings, bonding connectors, etc. for a complete installation.
4. Closure system shall be air and water tight. Closure system shall be RUS listed and UL approved.
5. Manufacturer: 3M Telcom, or equal:
  - a. #R-3
  - b. #4460-D; shield bond connector for cables 100-pair or smaller
  - c. #25T Ground Braid or #25T Ground Braid with Eyelets

**C. Encapsulant**

1. Application: Encapsulant shall be suitable for outdoor installation within underground splice closures (vault and/or maintenance hole).
2. Encapsulant shall be re-enterable.
3. Manufacturer: 3M Telcom, or equal:
  - a. #4442; “High Gel” re-enterable encapsulant

**2.03 SPLICE MODULES**

**A. Splice Module – 710 Dry Straight Type**

1. Application: Cable transition (OSP to ISP) in telecom rooms.
2. Modules shall accept mixed solid wire gauges (26 AWG – 19 AWG).
3. Modules shall accept mixed insulation types (PIC, PVC, pulp or paper insulated conductors), up to maximum insulation outside diameter of (.70).
4. Manufacturer: 3M Telcom, or equal:
  - a. #3M710-SD1-25; 25-pair 710 dry straight splicing module

**B. Splice Module – 710 Filled Straight Type**

1. Application: In-line or branch splicing of OSP cables in underground vaults or manholes.
2. Modules shall accept mixed solid wire gauges (26 AWG – 19 AWG).
3. Modules shall accept PIC or PVC insulation.
4. Modules shall be “preloaded” (filled) with water resistant compound.
5. Manufacturer: 3M Telcom, or equal:
  - a. #3M710-SC1-25; 25-pair 710 filled straight splicing module



## 2.04 BUILDING ENTRANCE PROTECTION

- A. General: All BEP terminals shall offer 110-compatible “output” connection type.
- B. BEP Terminal – 190 Type
  - 1. Application: BEP terminal shall be suitable for indoor installation, within a telecom room (such as an Entrance Facility or ‘MPOE’). BEP terminals shall provide termination of the backbone twisted pair cables and shall protect premises equipment against induced voltages and stray currents.
  - 2. Configuration: BEP terminal shall be designed for a wall mounted configuration, shall have the capacity to accept 50 or 100 incoming and outgoing pairs, and shall accept 5-pin type protector modules.
  - 3. Media Interfaces:
    - a. Input shall be 25-foot 26 AWG fusible link stub.
    - b. Output shall be 25-foot 24 AWG stub.
  - 4. Manufacturers:
    - a. Porta Systems #26xxx-ST-MST; 190 type BEP terminal, where “xxx” = pair count
    - b. CommScope SYSTIMAX #190A1-50; 50-pair 190 type BEP terminal
- C. BEP Modules – With Sneak Current Protection
  - 1. BEP modules shall be standard 5-pin type, and be suitable for installation into BEP terminals.
  - 2. Overvoltage Device: solid state. DC Breakdown Voltage: 220 V. Response time: <100 nsec.
  - 3. Sneak Current Device: heat coil. Sneak Current: 1 A. Response Time: < 15 sec.
  - 4. Manufacturers:
    - a. Porta Systems #115SCG-250V; solid state module, 220V – 300V breakdown voltage with sneak current protection, black
    - b. CommScope SYSTIMAX #4C1S; solid state module, 220V – 300V breakdown voltage with sneak current protection, black

## 2.05 MISCELLANEOUS MATERIALS

- A. OSP Backbone Cable Labels
  - 1. General: Labels shall be machine printable with a laser printer, ink jet printer, thermal transfer printer, or hand-held printer. Labels shall be adhesive backed and have a self-laminating feature.
  - 2. Printable Area: 2” x 0.5”, minimum.
  - 3. Color: White.
  - 4. Manufacturer: Panduit, or equal.
    - a. LJSL7-Y3-1; laser/ink jet labels for cable diameters 0.16”-0.32”, white
    - b. LJSL8-Y3-1; laser/ink jet labels for cable diameters 0.31”-0.69”, white
    - c. LJSL19-Y3-1; laser/ink jet labels for cable diameters 0.31”-1.42”, white
- B. Simplex entry seals for 4-inch conduit
  - 1. Seal shall create a water-tight seal between the inside of the conduit and the cable. Provide plug sized appropriately.
  - 2. Manufacturer: Tyco, or equal by Carlon.
    - a. #40S136S; for cable OD 1.19-1.36

- b. #40S196SB; for cable OD 1.38-1.96
- c. #40S256SB, for cable OD 1.92-2.56
- d. #40S291SB, for cable OD 2.56-2.91
- e. #40S327SB, for cable OD 2.91-3.27

### **PART 3 - EXECUTION**

#### **3.01 GENERAL**

- A. Comply with Division 01 General Execution requirements.
- B. Install products, components, accessories, hardware, etc, according to the manufacturer's instructions.

#### **3.02 EXAMINATION**

- A. Pathways: Prior to installation, verify pathways (underground conduits, etc.) are complete and ready for cables.

#### **3.03 PREPARATION**

- A. Verify cable is fully operational – both cable sheath and conductors – prior to installation.
- B. Pre-installation testing as described in section 27 08 00 is not required and shall be the responsibility of the Contractor.

#### **3.04 INSTALLATION**

- A. OSP Interbuilding Backbone Cable
  - 1. Each and every cable run between either termination points or designated splices points shall be a continuous single cable, homogenous in nature. Only splices as noted on the Construction Documents will be permitted.
  - 2. Placement
    - a. Bend Radius: Maintain a minimum bend radius of 6 times the cable diameter during and after installation.
    - b. Pulling: Maintain pulling tension within manufacturer's limits. Only use UL approved cable-pulling compounds when necessary to reduce pulling tensions.
    - c. Protection: Protect cable during installation. Place and suspend cables in a manner to protect them from physical interference or damage. Replace cable if damaged during installation.
    - d. Place cables with no kinks, twists, or impact damage to the sheath.
    - e. Cables shall be neatly dressed and organized in the cable routing facilities, and fastened to support devices via tie wraps.
  - 3. Routing:
    - a. Install cables within designated pathways.
    - b. Route cables a minimum of 6" away from power sources to reduce interference from EMI.
    - c. When routing horizontally within telecommunications rooms, utilize the overhead cable support; route backbone cables to avoid crossing over horizontal cabling or horizontal cabling crossing backbone cabling. When routing vertically within telecommunications rooms, utilize the vertical cable support (if available) and provide cable ties every 24 inches on center using.

4. Termination
    - a. Provide a 8-12 foot sheathed cable slack loop at each end of the run. Store the slack in the overhead cable support.
    - b. Terminate copper pairs at both ends on the specified BEP / termination apparatus.
    - c. Properly strain relieve cables at designated points per manufacturer's instructions.
  5. Labeling
    - a. Provide labels on each end of the cable, no more than 4" from where the cable enters the specified splicing enclosure / termination apparatus.
    - b. Place labels such that they are visible by a technician from a normal stance.
- B. Underground Splicing Systems
1. Provide underground splice systems either as shown on the drawings or as shown on shop drawing submittal, including closure, end caps, splice modules, grounding components, and all accessories required for a complete installation. Install splice closure and splice modules per manufacturer's instructions using tools intended for the purpose. Provide re-enterable encapsulant within enclosure.
  2. Install closure onto rack system within maintenance hole, as shown on drawings.
  3. Grounding and Bonding
    - a. Bond cable shield to splice closure bond assembly. Provide bonding conductor from splice closure bond terminal to ground terminal within maintenance hole, if available.
    - b. Size bonding conductor 6 AWG up to 25 feet in length; size as 1000 circular mils per foot if longer than 25 feet.
  4. Labeling
    - a. Provide labels on each splice module and binder group in splice closure.
- C. Building Entrance Splicing Systems
1. Provide entrance splice system as shown on the Drawings, including closure, end caps, splice modules, grounding components, and all accessories required for a complete installation. Install splice closure and splice modules per manufacturer's instructions using tools intended for the purpose.
  2. Fill unused end cap entry holes with appropriate plug (intended for purpose) for future use.
  3. Thoroughly clean and separate all binder groups prior to installing splice modules.
  4. Grounding and Bonding
    - a. Bond splice enclosure and cable shield to closet busbar using bonding conductor per manufacturer's instructions and/or ANSI/J-STD-607-A requirements.
    - b. Size bonding conductor 6 AWG up to 25 feet in length; size as 1000 circular mils per foot if longer than 25 feet.
  5. Labeling
    - a. Provide labels on each splice module and binder group in splice closure.
- D. Building Entrance Protection Terminals
1. Provide BEP system as shown on the Drawings, including terminals, modules, and all accessories required for a complete installation. Install BEP per manufacturer's instructions.
  2. Install BEP terminals plumb and square, and at height shown on Drawings. If no height is shown, install such that bottom row is at 24" AFF (+/- 3").
  3. Provide quantity of protector modules to completely populate terminals.

4. Grounding and Bonding
  - a. Bond BEP terminal to closet busbar using bonding conductor per manufacturer's instructions and/or ANSI/J-STD-607-A requirements.
  - b. Size bonding conductor 6 AWG up to 25 feet in length; size as 1000 circular mils per foot if longer than 25 feet.
5. Labeling
  - a. Provide and permanently affix label on the terminal's cover.
  - b. Provide label in the label holder at the terminal's "outgoing" connection.

### **3.05 LABELING**

#### **A. General Requirements**

1. Identifier assignment and scope of labeling shall conform to TIA/EIA-606-A and as approved by the Owner. Label colors shall conform to TIA/EIA-606-A.
2. Labels shall be permanent and machine-generated; hand written labels will not be accepted.

#### **B. Label Formats**

1. Cable Labels
  - a. Text shall black, and shall be 1/8" high, minimum, or #12 font size.
  - b. Install labels no more than 4" from the edge of the cable jacket. Fully wrap label around the cable jacket. Install labels such that they are visible by a technician from a normal stance.
2. BEP Labels – "Output" Connection
  - a. Text shall black, and shall be 3/32" high, minimum, or #10 font size.
  - b. Labels shall either be included in the product packaging or shall be fully compatible, in the opinion of the Engineer, with the specified termination apparatus.

#### **C. Identifier Assignment**

1. General: Separate all label fields of the identifier with a hyphen.
2. Backbone OSP Twisted Pair Cables
  - a. The first field shall identify the beginning and ending pair counts.
  - b. The second field shall identify the originating termination room identifier and the destination termination room as shown on the plans.
  - c. Identifier Example: "0001-0200 B08-TDA-B30-TDA"
3. BEP Terminal Cover
  - a. The first field of the identifier shall be the pair count; e.g., "0001-0200".
  - b. The second field of the identifier shall be cable's other end room; e.g., "FROM B08-TDA".

### **3.06 INSPECTION AND ADJUSTMENTS**

- A. Inspect installed products and completed work in conjunction with the Owner, or Owner's Representative. Develop a punchlist for items needing correction.
- B. Provide punchlist to Owner, or Owner's Representative. for review prior to performing punchlist with the Engineer.
- C. Repair defects prior to system acceptance.

- D. Inspect installed products and work in conjunction with the Owner, or Owner's Representative. for sign off.

**3.07 DEMONSTRATION**

- A. On completion of the acceptance test, schedule a time convenient with the Owner, or Owner's Representative, for instruction in the layout and maintenance of the system.

**3.08 CERTIFICATION**

- A. Provide the Owner, or Owner's Representative, with a written form of acceptance for signature.

**END OF SECTION**



**SECTION 27 13 24**

**TELECOMMUNICATIONS BACKBONE OSP FIBER OPTIC CABLING**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section includes: Backbone outside plant (OSP) fiber optic cabling.
- B. Related Sections
  - 1. Comply with the Related Sections paragraph of Section 27 00 00.
  - 2. Section 27 08 00 - Telecommunications Testing
- C. Products Furnished and Installed under another Section:
  - 1. Conduits, pullboxes, and other underground pathways

**1.02 REFERENCES**

- A. Comply with Division 01 References requirements.

**1.03 DEFINITIONS**

- A. Refer to Division 01 for Definitions.
- B. In addition to those terms listed in Division 01, the following terms as used in this specification shall be defined as follows:
  - 1. "HDPE": High Density Polyethylene
  - 2. "LDPE": Light Density Polyethylene
  - 3. "MDPE": Medium Density Polyethylene
  - 4. "MMF": Multimode fiber type
  - 5. "PE": Polyethylene
  - 6. "SMF": Singlemode fiber type

**1.04 SYSTEM DESCRIPTION**

- A. General
  - 1. Refer to Division 01 for a full description of the project and building.
- B. Work
  - 1. Work includes engineering, labor, materials, apparatus, tools, equipment, and transportation required to make a complete working telecom backbone fiber optic cabling system installation described in these specifications.
  - 2. Cabling, including terminations at both ends, shown on Drawings shall be considered as the work, unless otherwise noted.
  - 3. The Drawings are diagrammatic in nature.

4. In general, the work includes:
  - a. Preconstruction Submittals
  - b. Backbone outside plant fiber optic cables and terminations
  - c. Innerduct, within existing pathways
  - d. Cable management
  - e. Cable identification tags and system labeling
  - f. Record Documents
  - g. Warranty

#### **1.05 SUBMITTALS**

- A. Comply with Submittal procedural, quantity, and format requirements of Division 01.
- B. Preconstruction Submittal Requirements:
  1. Product Data Submittal, indicating conformance with NEC, UL, TIA/EIA listings, certifications and specifications.
  2. Schedule Submittal, consisting of proposed schedule of work.
  3. Shop Drawings Submittal, consisting of proposed changes to cable routing, or termination locations/configurations.
- C. Submittal Requirements at Closeout:
  1. Copy of the manufacturer's printed reel documentation, including the following.
    - a. Manufacturer's reel number.
    - b. Manufacturer's traceable batch number.
    - c. Length of the fiber cable on the reel.
    - d. Maximum attenuation
    - e. Minimum bandwidth
  2. Test results of the installed fiber optic cable – both printed copies and electronic copies.
  3. As-Built Drawings.
  4. O & M Manuals.

#### **1.06 QUALITY ASSURANCE**

- A. Comply with Quality Assurance requirements of Division 01
- B. Contractor Qualifications
  1. In addition to the Contractor Qualifications requirements of Section 27 00 00, the Contractor shall be manufacturer certified to install the proposed and submitted cabling system and to provide an extended warranty. Provide satisfactory evidence of certification in the form of a current letter or certificate from the manufacturer as part of the bid submission.

#### **1.07 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. The OSP cabling shall be warranted under the minimum Project warranty. Refer to Division 01 for requirements.



## 1.08 WARRANTY

- A. The telecommunications cabling system, as specified in this section, shall carry a 15 year (minimum) extended system warranty. This extended warranty shall cover parts and labor for the duration of the extended warranty. This extended warranty shall also cover optical performance of cabling system.

## PART 2 - PRODUCTS

### 2.01 UNDERGROUND FIBER OPTIC CABLES

- A. Application:
1. Cable shall be suitable for outdoor installations within underground conduit.
  2. Cable and fiber strands shall exhibit stable performance in an outdoor environment. The optical transmission performance of the fiber shall not be significantly affected by environmental fluctuations, installation, or aging.
  3. Materials used in the cable shall not emit hydrogen in quantities that will increase attenuation.
- B. Singlemode fiber strands shall meet or exceed the following geometry criteria:
1. Core diameter = 8.3  $\mu\text{m}$ .
  2. Mode field diameter = 8.8  $\mu\text{m}$ ,  $\pm 0.5 \mu\text{m}$ .
  3. Cladding diameter = 125  $\mu\text{m}$ ,  $\pm 1.0 \mu\text{m}$ .
  4. Core/Cladding Concentricity =  $\leq 0.8 \mu\text{m}$ .
  5. Minimum Tensile Strength = 100,000 psi.
- C. Singlemode fiber strands shall meet or exceed the following performance criteria:
1. Attenuation = 0.4 dB/km at 1310 nm and 0.3 dB/km at 1550 nm wavelengths, maximum.
  2. Cutoff wavelength = 1260 nm.
  3. Dispersion = 3.5 ps/nm•km at 1285-1330 nm.
- D. Buffering:
1. Fibers shall be loosely buffered, either in a core tube or in multiple tubes around a dielectric central member.
  2. The buffer tube/tubes shall be flooded with filling compound to protect against moisture penetration. Filling compound: "FLEXGEL", or equal.
  3. Buffer Tubes (if applicable): Each buffer tube shall be color coded to allow identification, and shall meet the requirements of ANSI/TIA/EIA-598-A-1995. (Also, ref. ANSI/ICEA Publication S-80-576, and EIA-230).
- E. Sheath:
1. Sheath shall consist of a central member, strength member and an outer jacket. Sheath shall be dielectric and contain no metallic components.
  2. Strength Member: Aramid yarn (e.g., Kevlar<sup>®</sup>), or reinforced fiberglass rods.
  3. Jacket: UV-resistant and listed OFCR and FT-4; meets National Electrical Code (NEC Article 770)
  4. Rated tensile load: 600 lb. maximum rated load.

5. Operating Temperature Range: -40 to 158°F (-40 to 70°C)

F. Manufacturer: Corning Cable Systems, or equal.

1. #012EW4-T4101D20; 12 strand singlemode outdoor 'ALTOS' dielectric sheath

## 2.02 TERMINATION EQUIPMENT

A. Fiber Optic Patch Panels

1. Passive fiber optic physical equipment and apparatus used in interconnecting and cross-connecting fiber optic cables shall possess a minimum fire resistant rating of UL94V-1.
2. The equipment, apparatus, and material for fiber optic equipment an apparatus shall conform to existing OSHA Health and Safety Laws. The equipment and apparatus shall have provision for the application of safety labels such as laser identification or warning labels as required by system considerations.
3. Fiber optic patch panel shall be a fully assembled rack mounted fiber optic enclosed housing for protecting, storing and organizing the termination of the fiber cable and all fiber strands at each end of the cable. The patch panel shall include an integrated patching facility.
4. The fiber patch panel must:
  - a. Provide means of strain relief and support of the specified cables.
  - b. Contain slack storage facilities for fiber slack.
  - c. Support 24 (minimum) fiber terminations.
  - d. Provide patch cord management.
5. "Fully assembled" shall include all required installation & mounting components, and include accessories such as connector panels, coupling adapters, etc. for a complete installation.
6. Manufacturer: Uniprise (by CommScope)
  - a. #RFE-FXG-EMT/1U; 1U fiber shelf, accepts 4 adapter plates
  - b. #SFA-SC06-BL; adapter plate – 6 simplex SC singlemode adapters, blue

## 2.03 CONNECTORS

A. Singlemode Fiber Optic Connectors – SC Type

1. Materials:
  - a. Ferrule: ceramic (zirconia or alumina) with pre-radiused finish/face.
  - b. Connector housing: plastic.
2. Connector shall have an integral strain relief feature, including a bend limiting rear boot.
3. Connectors shall be blue.
4. Connectors shall be installable via either epoxy or anaerobic method.
5. Manufacturer: Corning Cable Systems, or equal.
  - a. #95-250-08-BP; SC connector, singlemode

## 2.04 OUTSIDE PLANT INNERDUCT

- A. Application: Outside plant innerduct shall be suitable for an outdoor installation within an underground pathways system (conduits, maintenance holes, etc.) to support of communications cables (primarily fiber optic cables) for the purpose of sub-ducting the pathways.
- B. Circular innerduct and of uniform cross-section to the dimensions in accordance with ASTM D3035.

- C. Continuous length of innerduct, smooth in/ribbed out with a low friction internal surface containing no welds or joints, coiled on a reel.
- D. Material: Extruded high-density polyethylene (HDPE) resin, in accordance to the requirements of ASTM D3350 Type III.
- E. Density, melt flow, tensile strength at yield, and environmental stress crack shall conform to the values listed ASTM D3350.
- F. Containing adequate added stabilization during the manufacturing process to protect the polyethylene against thermal and UV degradation throughout the projected lifespan of the finished product.
- G. Innerduct shall contain a pre-installed pulling tape or rope; minimum pull tension rating of 1,000 pounds.
- H. Colors: white, orange, black, and yellow.
- I. Manufacturers:
  - 1. Arnco
  - 2. Carlon
  - 3. Dura-line
  - 4. Endot
  - 5. Or equal

## **2.05 MISCELLANEOUS COMPONENTS**

- A. Cable Labels
  - 1. Labels shall be machine printable with a laser printer, ink jet printer, thermal transfer printer, or hand-held printer.
  - 2. Labels shall be adhesive backed and have a self-laminating feature.
  - 3. Labels shall fit the backbone fiber cables listed above (i.e., shall fully wrap around the cable's jacket).
  - 4. Printable Area shall be 2" x 0.5", minimum, in size, and shall be white in color.
  - 5. Manufacturer: Panduit.
    - a. #LJSL7-Y3-1; laser/ink jet labels, for cable diameters 0.16"-0.32", white
    - b. #LJSL8-Y3-1; laser/ink jet labels, for cable diameters 0.32"-0.69", white
- B. Cable Slack Storage Reel: Leviton #48900-OFR, Condux or equal.

## **2.06 DUCT PLUGS**

- A. Innerduct plugs
  - 1. Manufacturer:
    - a. Tyco
      - 1) #10S035S; 1-inch fiber optic simplex plug
      - 2) #11S057SB; 1 ¼-inch fiber optic simplex plug
      - 3) #10D104U; 1-inch blank plug
      - 4) #12D148U; 1 ¼-inch blank plug
    - b. Or equal by Carlon

### **PART 3 - EXECUTION**

#### **3.01 GENERAL**

- A. Comply General Execution requirements of Division 01.

#### **3.02 EXAMINATION**

- A. Pathways: Prior to installation, verify pathways (conduits, etc.) exist and are 'ready' to accept cables.
- B. Building 30: Prior to installation, verify Building 30 is 'ready' to accept the backbone cables and terminations.

#### **3.03 PREPARATION**

- A. The Contractor is solely responsible to verify that the twisted pair cable is operational – both cable sheath and strand continuity – prior to installation.
- B. Documentation of pre-installation testing is not a close out requirement, and shall be the responsibility of the Contractor.

#### **3.04 INSTALLATION**

##### **A. Backbone Cable**

##### **1. General**

- a. Cable runs shall have continuous sheath continuity, homogenous in nature. Splices are not permitted, unless approved in writing by the Engineer prior to installation.
- b. Protect fibers during installation & termination. Fibers damaged beyond repair during installation or termination shall result in replacement of the affected cable at no additional cost.

##### **2. Placement**

- a. Place dielectric outside plant fiber optic cables within subduct/innerduct.
- b. Bend Radius: Maintain a minimum bend radius of 20 times the cable diameter during installation, and a minimum bend radius of 10 times the cable diameter after installation.
- c. Pulling: Maintain pulling tension within manufacturer's limits. Use a pulling tension meter when using mechanical assistance during installation. Record maximum pulling tension for each cable run and submit to the Engineer for review if requested. Replace runs when manufacturer's maximum pulling tension is exceeded.
- d. Protection: Place and suspend cables in a manner to protect them from physical interference or damage. Replace cable if damaged during installation.
- e. Place cables with no kinks, twists, or impact damage to the sheath.
- f. Only use UL approved cable-pulling compounds when necessary to reduce pulling tensions.
- g. Secure cables at each telecommunications vault and building entrance with duct plugs.
- h. Provide a 30 feet (minimum) sheathed cable slack loop at each end of the run within the Communications Rooms; place the slack in the overhead cable tray/runway.

##### **3. Routing**

- a. Route cables in conduit/innerduct between points of termination throughout entire length (except at the fiber take up reel).
- b. Install cables within designated pathways.

- c. Neatly dress and organize cables using designated cable routing facilities, and fasten to support devices via tie wraps or Velcro-type straps.
  - d. When routing horizontally within telecom rooms, utilize the overhead cable support. When routing vertically within telecom rooms, utilize the wall mounted vertical cable support and properly fasten. "Properly fasten" shall consist of cable ties in a 'crossed' configuration per cable or cable bundle (up to three cables or innerducts) every 24 inches on center.
  - e. Secure cabling to communication vault sidewall by use of racking. Provide racking if not already present in vault.
  - f. Place and suspend cables in a manner to protect them from physical interference or damage.
  - g. Provide a 30 feet (minimum) sheathed cable slack loop at each end of the run. Store slack in slack storage ring mounted on the wall.
4. Termination
- a. Provide the termination panel in designated equipment rack; per drawings (if not shown, locate at the top of inside rack).
  - b. Provide accessories required for proper installation of each termination panel, including connector panels and adapters.
  - c. Properly relieve strain from cables at termination points (at/within the fiber optic termination panels) per manufacturer's instructions.
  - d. Terminate/connectorize fiber strands at both ends using the specified fiber optic connectors appropriate for the mode type of the fiber. Perform terminations in accordance with manufacturer's instructions.
  - e. Provide required tools, consumables and accessories for complete termination of fiber strands.
  - f. Provide 2-3 feet of unsheathed fiber slack within the patch panel/termination enclosure at each end of the run. Properly store fiber slack in rear of patch panel into the 'routing rings', per manufacturer's instructions. Include 'extension' slack loop/fold in the rear of the shelf to allow the drawer to be pulled out without putting tension on the fibers.

B. Duct Plugs

1. Provide duct plugs at each telecommunications vault and building entrance.
2. Provide blank plugs for unused conduits and innerducts.

**3.05 LABELING**

A. General Requirements

1. Labeling and identifier assignment shall conform to the TIA/EIA-606-A Administration Standard and as approved by Owner's Representative before installation. Label colors shall conform to the TIA/EIA-606-A Administration Standard.
2. Labels shall be permanent and machine-generated; hand written labels will not be accepted.

B. Label Formats

1. Cable Labels
  - a. Text shall black, and shall be 1/8" high, minimum, or #12 font size.
  - b. Provide labels on both ends of cables. Install labels no more than 4" from the edge of the cable jacket. Fully wrap label around the cable jacket. Install labels such that they are visible by a technician from a normal stance.

2. Termination Apparatus Labels
  - a. Labels shall either be included in the product packaging or shall be fully compatible, in the opinion of the Engineer, with the block system.
  - b. Provide brown label respective field type, per TIA/EIA-606-A.
  - c. Text shall black, and shall be 3/32" high, minimum, or #10 font size.

C. Identifier Assignment

1. General: Separate all label fields of the identifier with a hyphen.
2. Cables
  - a. First field shall identify the originating termination room identifier as shown on the plans; for example, "B0\*-TDA".
  - b. Second field shall identify the ending termination room identifier as shown on the plans; for example, "B30-TDA".
  - c. Third field shall identify the type and number of strands; for example, "Sxxx" where "S" stands for singlemode and xxx stands for the ending fiber strand sequential count.
  - d. Example: "B08-TDA- B30-TDB-S025-S036"
3. Termination Positions at the Termination Panels
  - a. The first field of the identifier shall be the fiber strand count; e.g., "0025-0048".
  - b. The second field of the identifier shall be cable's other end room; e.g., "FROM B08-TDA".

**3.06 FINAL INSPECTION**

- A. Inspect installed products and work in conjunction with the Owner or Owner's Representative. Develop a punchlist for items needing correction.
- B. Issue punchlist to Engineer for review prior to performing punchlist with the Engineer.
- C. Repair defects prior to system acceptance.
- D. Inspect installed products and work in conjunction with the Engineer for sign off.

**END OF SECTION**

**SECTION 27 15 13**

**TELECOMMUNICATIONS HORIZONTAL CABLING**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section Includes: Horizontal Cabling and Equipment Cabinet.
- B. Related Sections
  - 1. Comply with the Related Sections paragraph of Section 27 00 00.
- C. Products Furnished and Installed Under Another Section:
  - 1. Conduits, sleeves, and other pathway systems for building distribution.
  - 2. Conduit stubs and device (back) boxes for devices/outlets.
  - 3. Surface raceway – base, cover, and device plates.

**1.02 REFERENCES**

- A. Comply with the References requirements of Section 27 00 00.

**1.03 DEFINITIONS**

- A. Refer to Section 27 00 00 for Definitions.
- B. In addition, the following list of terms as used in this specification shall be defined as follows:
  - 1. “CAT6”: Category 6 [UTP]
  - 2. “Channel”: End to end transmission path; e.g., the entire portion of the horizontal cabling to each outlet consisting of the Permanent Link, line cord (at the workstation), patch cord, and, if a full cross-connection is implemented, the cross-connect termination/connecting apparatus and equipment cord.
  - 3. “CMP”: Communications Media Plenum, plenum rating; synonymous with “MPP”
  - 4. “CMR”: Communications Media Riser, riser rating; synonymous with “MPR”
  - 5. “FEP”: Fluorinated Ethylene Propylene
  - 6. “Permanent Link”: Test configuration for a horizontal cabling link excluding test cords, connections at the ends of the test cords, patch cords, equipment cords, line cords; e.g., the ‘permanent’ portion of the horizontal cabling to each outlet consisting of cable, consolidation point (if used), termination/connecting apparatus in the Telecommunications Room and the connector at the outlet.
  - 7. “PVC”: PolyVinyl Chloride
  - 8. “UTP”: Unshielded Twisted Pair

#### **1.04 SYSTEM DESCRIPTION**

A. Work

1. Provide engineering, labor, materials, apparatus, tools, equipment, and transportation required to make a complete working telecommunications Horizontal Cabling System installation described in these specifications.
2. Consider horizontal cabling as shown on Drawings to be base work, unless otherwise noted.

B. In general, the work includes:

1. Preconstruction Submittals
2. Horizontal cables, terminations, and outlets
3. Cable management
4. Patch cords and cross-connects
5. Equipment Cabinet
6. Cable identification tags and system labeling
7. Record Documents
8. Warranty

#### **1.05 SUBMITTALS**

A. Comply with the Submittals article of Section 27 00 00 for procedural, quantity, and format requirements.

B. Preconstruction Submittal Requirements:

1. Product Data Submittal, indicating conformance with NEC, UL, TIA/EIA listings, certifications and specifications.
2. Shop Drawings Submittal, consisting of proposed changes to cable routing, or termination locations/configurations.
3. Typical Outlet Sample, including faceplate, faceplate label, connectors/jacks, port labels, cables (about 12" sample), and cable label.
4. Seismic Calculations: Rack anchorage into concrete flooring with overall rack bracing, based on maximum rated load capacity.

C. Closeout Submittal Requirements:

1. As-Built Drawings.
2. Cross-connection records/cut sheets.
3. O & M Manuals.

#### **1.06 QUALITY ASSURANCE**

A. Comply with the Quality Assurance requirements of Section 27 00 00.

B. Contractor Qualifications

1. In addition to the Contractor Qualifications requirements of Section 27 00 00, the Telecommunications Installer shall be a Panduit Certified Installer (PCI), certified by Panduit



Corporation, and shall be capable of providing an extended warranty in the CertificationPlus system warranty program.

2. Provide evidence in the bid submission of certification in the PCI program. Evidence shall consist of a "Certification Of Participation" issued by Panduit Corp listing the Telecommunications Installer's company name.

#### **1.07 DELIVERY, STORAGE AND HANDLING**

- A. Comply with the Delivery, Storage and Handling requirements of Section 27 00 00.

#### **1.08 WARRANTY**

- A. The telecommunications horizontal cabling system, as specified in this section, shall receive a CertificationPlus system warranty. This extended warranty shall cover parts and labor for the duration of the extended warranty. This extended warranty shall also cover electrical performance of cabling system to the specific category per ANSI/TIA/EIA-568-B performance criteria for Permanent Link.

### **PART 2 - PRODUCTS**

#### **2.01 SUBSTITUTIONS**

- A. Comply with the Substitutions requirements of Section 27 00 00.

#### **2.02 CABLE – PLENUM (CMP) 4-PAIR UTP**

- A. Application: Suitable for indoor installation.
- B. Conductors:
  1. Insulated Conductors: 23 AWG solid-copper fully-insulated with a flame retardant thermoplastic material (material = PVC, or equivalent).
  2. Twisted Pairs: Two insulated conductors twisted to form a pair (twisted pair), and individually color-coded to industry standards (ANSI/ICEA Publication S-80-576-1994, and EIA-230).
- C. Cable Sheath:
  1. The cable shall be unshielded.
  2. Outer jacket shall be seamless (material = LS-PVC, or similar) applied to and completely covering the internal components (four twisted pairs).
  3. Flame Rating: NEC (Article 800) rated as CMP, and UL listed as such.
  4. Cable sheath shall be round.
- D. Electrical Performance: Meet or exceed TIA/EIA-568-B.2-1 and ISO/IEC 11801 requirements for CAT6 UTP cabling.
- E. Packaging: Cable shall come as 1,000 foot put-ups packaged in a box.
- F. Manufacturer: Panduit, or equal by Berk-Tek, General Cable, SYSTIMAX, CommScope, or Belden
  1. #PUP6004BU-U, "TX6000" CAT6 UTP CMP, Blue
  2. #PUP6004GY-U, "TX6000" CAT6 UTP CMP, Gray

### **2.03 MODULAR PATCH CORDS**

- A. Application: Suitable for indoor installation within a telecommunications room or workstation environment. Cords shall be assembled from a single, continuous length of cordage, homogenous in nature, and shall be terminated at both ends via 8 position modular plugs. Splices are not permitted anywhere.
- B. Cordage
  - 1. Insulated Conductors: 24 AWG stranded copper, fully insulated with a flame retardant thermoplastic material (such as PVC, or equivalent).
  - 2. Twisted Pairs: Two insulated conductors “twisted” into a “pair” (twisted pair), and individually color-coded.
  - 3. Sheath shall be unshielded, flame-retardant polyvinyl chloride (PVC) jacketed.
  - 4. Flame Rating: NEC CM (or higher) rated and UL listed as such.
- C. Electrical Performance: Comply with TIA/EIA 568-B for CAT6 UTP patch cords and Channel requirements (minimum).
- D. Manufacturer: Panduit
  - 1. #UTPSPx (“x” varies for length)

### **2.04 TERMINATION APPARATUS – PATCH PANEL**

- A. Application: Patch panel shall be suitable for installation within a telecommunication room for the termination of the CAT6 UTP 4-Pair Cable (specified herein), and shall be horizontally oriented for a rack-mounted configuration.
- B. Patch panel shall have discrete ports, fully compatible with the connectors / modular jacks – refer to this section for connectors.
- C. Patch panels shall be capable of supporting, organizing, labeling and patching/crossconnecting between the horizontal termination field and the equipment and/or the equipment termination field.
- D. Manufacturer: Panduit
  - 1. #CPPL24M6BL; 24-port discrete patch panel – less connectors/modular jacks

### **2.05 WORKSTATION OUTLETS**

- A. Faceplate for Flush Mount Outlets
  - 1. Refer to outlet schedule in the Drawings for port quantity per outlet type.
  - 2. Faceplate shall include required accessories, such as icons, blank inserts, and labels. Faceplate shall be by the same manufacturer as the connectors.
  - 3. Faceplate shall be “Executive” series, “IE” color.
  - 4. Manufacturer: Panduit
    - a. #CFPE2IE; Mini-Com line Executive series faceplate, 2-port
    - b. #CFPE4IE; Mini-Com line Executive series faceplate, 4-port
- B. Faceplate for Wall Phone Outlets
  - 1. Faceplate for wall phone outlets shall come equipped with 1 modular jack and two mounting studs.

2. Manufacturer: Panduit
  - a. #KWP6PY; Faceplate for wall phone, with modular jack.

## **2.06 CONNECTORS – MODULAR 8-POSITION JACKS**

- A. Connectors shall be 8-position 8-conductor modular type, shall be CAT6 rated, and shall be intended for the termination of 4-pair UTP cables. Connectors shall be by the same manufacturer as the faceplates.
- B. Connectors shall be T568B wired.
- C. Manufacturer: Panduit
  1. #CJ688TGOR; Mini-Com TX6 Plus Jack Module, Orange

## **2.07 COURTESY/CAMPUS PHONE**

- A. Indoor, wall-mount type: Allen Tel #GB306V

## **2.08 WIRELESS LAN ACCESS POINT ENCLOSURE**

- A. Indoor ceiling-mount type: Oberon #1055
- B. Indoor wall-mount type: Oberon #1023-00

## **2.09 EQUIPMENT CABINET, ENVIRONMENTALLY CONTROLLED**

- A. Application: Suitable for the support of network equipment, IT equipment (servers, storage devices, etc.), termination apparatus, cable & cord management apparatus, common communications equipment, and other similar equipment.
- B. Assembly:
  1. Cabinet includes integrated air conditioning unit, UPS, and PDU.
- C. Static load rating: 2,000 lbs.
- D. Exterior (Overall) Dimensions: 59.1” high x 23.5” wide x 38” deep.
- E. Mounting Rails:
  1. 22U capacity
- F. Manufacturer:
  1. Liebert
    - a. #HD448D0C0KE865; “MCR” cabinet, black; includes rack, cooling module, 2kVA UPS, and PDU, without optional casters

## **2.10 LABELS**

- A. Labels shall be machine printable with a laser printer, ink jet printer, thermal transfer printer, or hand-held printer.
- B. Cable Labels
  1. Labels shall be adhesive backed and have a self-laminating feature.
  2. Labels shall wrap around the cable’s jacket.

3. Printable Area: size: 2" x 0.5", minimum; color: white.
  4. Manufacturer, or equal: Panduit.
    - a. #LJSL7-Y3-1; laser/ink jet labels for cable diameters 0.16"-0.32", white
- C. Faceplate and Port Labels
1. Labels shall be adhesive backed.
  2. Port labels shall fit above the port without overlap to the next port or to the port itself.
  3. Manufacturer, or equal: Panduit.
    - a. #C125X030FJJ; "Equipment Room Identifier" label, for laser printer
    - b. #C061X030FJJ; "Unique Cable Number" label, for laser printer
- D. Patch Panel Labels
1. Labels shall be adhesive backed.
  2. Labels shall fit above the port without overlap to the next port or to the port itself.
  3. Printable Area: size: 0.61" x 0.33", minimum; color: white.
  4. Manufacturer, or equal: Panduit.
    - a. #CPPLF-5; laser labels for modular patch panels, white

## **2.11 MISCELLANEOUS COMPONENTS**

- A. Velcro Cable Ties
1. Width: .75".
  2. Color: Velcro cable ties shall be the same color as the cable to which it is being applied.
  3. Manufacturer, or equal: Panduit
    - a. #HLS-15R-0 Black, 15' roll, cut to length.

## **PART 3 - EXECUTION**

### **3.01 GENERAL**

- A. Comply with the Execution requirements of Section 27 00 00.
- B. Install products, components, accessories, hardware, etc, according to the manufacturer's instructions.

### **3.02 EXAMINATION**

- A. Pathways: Prior to installation, verify pathways are complete and ready for cables.

### **3.03 INSTALLATION**

- A. Horizontal Cable
1. General
    - a. Cable runs shall have continuous sheath continuity, homogenous in nature. Splices are not permitted anywhere.
    - b. Maintain maximum cable length of 90 meters from the termination in the Telecommunications Room to the termination at the outlet.
    - c. A cable bundle shall contain no more than 24 individual cables.

2. Color:
    - a. Provide Blue cables for data links.
    - b. Provide Gray cables for voice-only links.
  3. Installation
    - a. Maintain a minimum bend radius of 6 times the cable diameter during and after installation.
    - b. Maintain pulling tension within manufacturer's limits.
    - c. Protect cable during installation. Replace cable if damaged during installation.
    - d. Place cables with no kinks, twists, or impact damage to the sheath.
    - e. Place and suspend cables in a manner to protect them from physical interference or damage.
  4. Routing
    - a. Route cables a minimum of 6" away from power sources to reduce interference from EMI.
    - b. When routing cables in areas without primary horizontal pathways, install cables onto secondary pathways or approved support devices, such as cable hangers.
    - c. Route cables at 90-degree angles, allowing for bending radius along corridors for ease of access. Do not route through an adjacent space if a corridor borders at least one wall of the room.
    - d. Provide 8 to 12 feet (minimum) of sheathed cable slack at each end of the run. At the workstation, place cable in ceiling space before the device conduit stub supported from a cable hanger.
    - e. Provide 4 to 6 inches of sheathed cable slack behind each workstation outlet faceplate. The slack cable shall be coiled inside the device box, the surface raceway, or within the wall, in accordance with the cabling manufacturer's installation standards.
    - f. At the equipment bay where floor-standing racks are used, divide horizontal cables equally between both sides of an equipment rack such that a cable does not travel past the midpoint of the rack prior to termination.
  5. Termination
    - a. Properly relieve strain from cables at termination points, per manufacturer's instructions and TIA/EIA-568-B standard installation practices.
    - b. Terminate pairs on the specified termination apparatus. Perform terminations in accordance with manufacturer's instructions and TIA/EIA-568-B standard installation practices.
- B. Patch Panels and Horizontal Management Panels
1. Provide discrete patch panels in a quantity to allow termination of data cables served from respective telecommunications room.
  2. Install the patch panels and horizontal management panels in the configuration as shown on the Drawings. Install patch panels level (relative to rack).
- C. Outlet Faceplates
1. Install faceplates plumb, square, and at the same level as adjacent device faceplates.
  2. Patch gaps around faceplates so that faceplate covers the entire opening.
  3. For surface raceway, color shall match electrical device and/or coverplate.

D. Outlet Modular Connectors

1. Terminate pairs on the specified modular connector. Perform terminations in accordance with manufacturer's instructions and TIA/EIA-568-B standard installation practices.
2. Replace terminations and connectors not passing the required media test.

E. Courtesy/ Campus Telephone

1. Provide backing plate.
2. Install phone unit to height noted in Drawings and per manufacturer's instructions, and in compliance with codes.
3. Obtain extension number from ITS.
4. Provide permanent label on phone unit that displays the telephone's extension.

F. Wireless LAN Access Point Enclosures

1. Refer to Drawings for enclosure cabling service and installation requirements.

G. Cords and Crossconnects

1. Splices in patch cords and crossconnect wire are prohibited.
2. Record crossconnections in IDFs for MDF crossconnection purposes and for record documents.
3. Color:
  - a. For digital handsets, provide: White-Blue / Blue-White
  - b. For analog handsets, provide: White-Red / Red-White

H. Rack Bays

1. Equipment Cabinet
  - a. Provide parts and accessories required to complete each cabinet. Completely assemble cabinets, according to manufacturer's instructions.
2. Anchoring/Bracing
  - a. Use concrete anchors approved by structural engineer.
  - b. Anchor racks to the structural floor at four points.
  - c. If required for seismic bracing, provide bracing devices (e.g., brackets, threaded rod with strut, etc.) attached to the wall or structure above using appropriate fasteners.
3. Horizontal Management Panels
  - a. Provide one management panel above each patch panel and on below the bottom patch panel in each rack bay where patch panels occur.
  - b. Provide fasteners and parts required to complete the installation.

**3.04 LABELING**

A. General Requirements

1. Labeling, identifier assignment, and label colors shall conform to TIA/EIA-606-A Administration Standard and as approved by Owner's Representative before installation.
2. Labels shall be permanent with machine-generated text; hand-written labels will not be accepted.

**B. Label Formats**

**1. Cable Labels**

- a. Text Attributes:
  - 1) Black,
  - 2) 1/8" high, minimum, or #12 font size.
  - 3) Font: Verdana preferred, or SansSerif or Arial acceptable.
- b. Install labels on both ends of cables no more than 4" from the edge of the cable jacket. Install labels such that they are visible by a technician from a normal stance.

**2. Modular Patch Panel Labels**

- a. Use modular patch panel labels included in the product packaging. (Approval by the Owner shall be required for other labels.)
- b. Use a label color for the respective field type, per TIA/EIA-606.
- c. Text Attributes: Black, 3/32" high, minimum, or #10 font size.

**3. Outlet Labels**

- a. Text Attributes: Black, 1/8" high, minimum, or #12 font size.
- b. Provide an "Equipment Room Identifier" label at the top of the faceplate with the serving telecommunication room's identifier (refer to 27 11 00 for telecommunication room identifier assignment).
- c. Provide a "Unique Cable Number" label above each port with the link's unique cable number.

**4. Equipment Cabinet Label Requirements: Provide one label plate per cabinet. Permanently affix label plate and center the label plate on the rack's front top angle.**

**C. Identifier Assignment**

**1. Horizontal Cables / Cabling Link**

- a. Assign each cable a unique number, in ascending order beginning with the number 1.

**2. Outlet Ports**

- a. The outlet ports shall be identical to the unique cable number.

**3. Modular Patch Panel Ports**

- a. The modular patch panel ports shall be identical to the unique cable number.

**4. Equipment Cabinet**

- a. Prefix: "CABINET"
- b. First field: the room identity; for example: "B30"
- c. Second field: the rack number; for example: "01"
- d. Example; "CABINET B30-01"

**3.05 FINAL INSPECTION**

- A. Inspect installed products and work in conjunction with the Owner. Develop a punchlist for items needing correction.
- B. Issue punchlist to the Owner for review prior to performing punchlist walk.
- C. Repair defects prior to system acceptance.
- D. Inspect installed products and work in conjunction with the Owner for sign off.

**END OF SECTION**



**SECTION 28 00 00**

**BASIC SECURITY SYSTEM REQUIREMENTS**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. This section includes general administrative and procedural requirements for the sections of Division 28, and is intended to supplement, not supersede, the requirements specified in Division 1.
- B. Related Sections
  - 1. General: Consult all other Sections, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable system.
  - 2. General and Supplementary Conditions: Drawings and general provisions of Contract and Division 1 of the Specifications, apply to Division 28.
  - 3. Section 07 84 00: Firestopping
  - 4. Section 08 71 00: Door Hardware
  - 5. Section 26 05 00: Electrical General Provisions
  - 6. Section 28 05 13: Security System Cabling
  - 7. Section 28 05 53: Security System Labeling
  - 8. Section 28 08 00: Security System Acceptance Testing
  - 9. Section 28 13 00: Access Control & Alarm Monitoring System
  - 10. Section 28 23 00: Video Surveillance System

**1.02 REFERENCES**

- A. Reference to codes, standards, specifications and recommendations of technical societies, trade organizations and governmental agencies shall mean that latest edition of such publications adopted and published prior to submittal of the bid. Consider such codes or standards a part of this Specification as though fully repeated herein.
- B. Codes: Perform work in accordance with all applicable requirements of the latest edition of all governing codes, rules and regulations including but not limited to the following minimum standards, whether statutory or not:
  - 1. California Code of Regulations (CCR)
    - a. Title 8, Industry Relations Chapter 3.22, California Occupational Safety and Health Regulations (CAL/OSHA)
    - b. Title 24, California Building Standards Code
      - 1) Part 2, Basic Building Regulations
      - 2) Part 3, California Electrical Code (CEC)
  - 2. National Fire Protection Agency (NFPA)
    - a. NFPA 70, "National Electrical Code" (NEC).
  - 3. National, State, Local and any other binding building and fire codes

4. FCC Regulations:
  - a. Part 15 – Radio Frequency Devices & Radiation Limits
- C. Standards: Equipment and materials furnished under this Section shall conform to the following standards where applicable:
  1. Underwriter's Laboratories (UL): Applicable listing and ratings.
    - a. UL 294: Access Control System Units
    - b. UL 1076: Proprietary Burglar Alarm Units and Systems
  2. EIA testing standards
- D. Make a copy of each document readily available during the course of construction for reference by field personnel.

### **1.03 DEFINITIONS**

- A. The Definitions of Division 1 shall apply to the 28xxxx sections.
- B. In addition to those Definitions of Division 1, the following list of terms as used in this specification shall be defined as follows:
  1. “ACAMS”: Access Control & Alarm Monitoring System
  2. “As directed”: As directed or instructed by the Owner, or their authorized representative.
  3. “Cabling”: A combination of all cables, wire, cords, and connecting hardware [e.g., cables, conductor terminations, connectors, outlets, patch panels, blocks, and labeling].
  4. “Connect”: To install all required patch cords, equipment cords, cross-connect wire, etc. to complete an electrical or optical circuit.
  5. “Furnish”: To purchase, procure, acquire, and deliver complete with related accessories.
  6. “Install”: To set in place, join, unite, fasten, link, attach, set up or otherwise connect together and test before turning over to the University, all parts, items, or equipment supplied by contractor. Installation shall be complete and ready for regular operation.
  7. “Provide”: To furnish, transport, install, erect, connect, test and turn over to the Owner, complete and ready for regular operation.
  8. “SEC”: Security Equipment Panels
  9. “VSS”: Video Surveillance System

### **1.04 SYSTEM DESCRIPTION**

- A. Overview
  1. Reference project specific scope.
- B. Drawings
  1. Layout: Follow the general layout shown on the Drawings except where other work may conflict with the Drawings.
  2. Accuracy: The Drawings show a diagrammatic representation of the system within the constraints of the symbology applied.
  3. The Drawings do not fully represent the entire installation for the Security System. Drawings indicate the layout and location of control components, as well as location of security devices, i.e.

card readers, door locks and contacts, glass break detectors, etc. The Drawings do not show all conduits, wire and cabling between every system component, equipment, device, etc.

4. Provide detailed point-to-point diagrams that allow the Contractor to achieve desired results using their own procedures and methods. Submit CAD shop drawings for review prior to installation
- C. Contractors Design Requirements
1. The Project Drawings represent the level of system design to be provided by the engineer. Contractor shall provide all additional system design work required, including:
    - a. Conduit layout and sizing
    - b. Wire and cable layout and sizing including type and quantity
    - c. Point-to-point wiring and equipment hook-up information
    - d. Equipment mounting details
    - e. Design of equipment cabinets and interface components
    - f. System one-line or block diagram
    - g. Other detailed design work required
    - h. Reflected ceiling plan for devices installed in ceiling
  2. Obtain shop drawings of other related systems that require integration and coordinate means and methods to complete the system as described and specified in these sections.

#### **1.05 SUBMITTALS**

- A. General: Submit required submittal(s) in accordance with General Conditions of the Contract, and Division 1 Submittal Procedures Section 013300
- B. Cover Letter: Include a cover letter stating that the submittal is in full compliance with the requirements of the Contract Documents. List in full the items and data submitted, signed (and stamped, if applicable) by the person who prepared the submittal. Failure to comply with this requirement shall constitute grounds for rejection of submittal.
- C. Submittal Description: Product Data
  1. General: Product data submittals must be approved by the Owner prior to release of order for equipment and prior to installation.
  2. Quantity: As noted in Division 1 (minimum of four).
  3. Format:
    - a. Provide each product data submittal in a 3-ring binder with front cover and spine clear pockets for insertion of the submittal information.
    - b. Clearly label the cover and the spine of each submittal with the following information:
      - 1) Client Name (e.g., "Cañada College").
      - 2) Project Number and Contract Number
      - 3) Project Name and Address (e.g., "Building 30").
      - 4) Contractor's Submittal Number
      - 5) Submittal Title (e.g., "Product Data Submittal For ACAMS System").
      - 6) Specification Section Number (e.g., "Section 281300").
      - 7) Date of Submittal – Format: Month Day, Year (e.g., "January 1, 2010").
      - 8) Contractor Name

- c. Include a Table Of Contents at the beginning of the submittal that lists materials by article and paragraph number found in the section and in the order outlined in the specification (e.g., "2.03-B Card Reader").
  - d. Include tabbed separators for improved navigation through the submittal.
  - e. Delivery dates for all equipment.
4. Content:
- a. Product Information:
    - 1) Include product data consisting of manufacturer's technical data, product literature, "catalog cuts", data sheets, specifications, and block wiring diagrams (if necessary). This data shall clearly describe the product's characteristics, physical and dimensional information, electrical performance data, materials used in fabrication, material color & finish, and other relevant information such as test data, typical usage examples, independent test agency information, and storage requirements.
    - 2) Clearly indicate by arrows or brackets precisely what is being submitted on and those optional accessories, which are included and those which are excluded.
    - 3) Include delivery dates for equipment.

D. Submittal Description: Shop Drawings

- 1. General: The Owner must approve shop drawings prior to release of order for equipment and prior to installation.
- 2. The Owner will provide electronic files via e-mail or via CD-ROM containing the contract documents drawing files for use in preparing shop drawings.
- 3. Quantity & Media: Furnish quantity and on media specified in Division 1.
- 4. Format:
  - a. Use AutoCAD 2007 or 2008.
  - b. Use the same sheet size and project title block as the Drawings.
  - c. Text Size: 3/32" high, minimum, when plotted at full size
  - d. Use identical symbols as those in the Design Drawings
  - e. Screen background information.
  - f. System components (devices, cable routes, etc.) and text shall be plotted at a sufficient line weight to stand out against background information.
  - g. Each sheet in the shop drawings set shall be labeled with the Specification Section Number (e.g., "282300").
  - h. Scaling:
    - 1) Floor plans shall be scaled at 1/8"=1'-0".
    - 2) Enlarged room plans shall be scaled 1/4"=1'-0".
    - 3) Wall elevations shall be scaled 1/2"=1'-0".
- 5. Content:
  - a. Floor Plans:
    - 1) Floor and site plans showing the locations of all devices and door furniture associated with each door locations (ex: contacts, rex locks, card readers) and cable routing paths with cable type and quantity called out. Prepare cable schedule if required to simplify sheet plan notation
    - 2) Provide termination information for each device on the plans or in a schedule that identifies the physical connections to the equipment panels. Include the panel address, and the termination point ID that is consistent and reflective of the programming fields.

- b. Point-to-Point Diagrams: Include all wiring, points of connection and interconnecting devices.
  - 1) Include all miscellaneous control relays.
  - 2) Include all devices connected to the system.
  - 3) Identify all conductors on the point-to-point diagrams with the same tag as the installed conductor.
- c. Block Diagram/Riser Diagram: Show the system components and all conduit and wire types and sizes between them including all cabling interties between termination hardware.
- d. Installation Details: Include installation details for all devices.
- e. Seismic Calculations: As part of the shop drawings submittal where applicable, the manufacturer shall provide anchorage calculations for floor mounted fully loaded distribution frames such that it shall remain attached to the mounting surface after experiencing forces in conformance with CCR, Title 24, Table 23P, Part II and with Section 2312 "Earthquake Regulations" of the "Uniform Building Code" for Seismic Zone 4 Area, Importance Factor of 1.25. Structural Calculations shall be prepared and signed by a California Registered Structural Engineer. Specify proof loads for drilled-in anchors, if used. Seismic calculation shop drawings shall be wet stamped and signed by a registered structural engineer.

E. Submittal Description: Labeling Sample

- 1. Quantity & Media: Furnish quantity indicated in Division 1.
- 2. Submit two sets of physical product samples for review and comment by Owner prior to the installation of equipment:
- 3. Content:
  - a. Provide panel label
  - b. Provide cable label on a cut length of cable.

F. Submittal Description: As-Built Drawings

- 1. Quantity & Media:
  - a. Submit a single set of half size prints of record drawings for review by the Owner.
  - b. Upon receipt of the Owner's review comments, make corrections and furnish the following record drawings:
    - 1) Two full-size sets on bond (or "eco-bond").
    - 2) One CD-ROM.
    - 3) One 11x17 set in the Record Documents Manual.
  - c. Drawings become Owner's property and shall maintain all ownership rights.
- 2. Format:
  - a. Prepare record drawings using AutoCAD 2007 or 2008.
  - b. Use the same sheet size and project title block as the Drawings.
  - c. Text Size: 3/32" high, minimum, when plotted at full size
  - d. Use identical symbols as those in the Drawings.
  - e. Screen background information.
  - f. All system components (devices, cable routes, etc.) and text shall be plotted at a sufficient line weight to stand out against background information.
- 3. Content:
  - a. Fully represent actual installed conditions and incorporate all revisions made during the course of construction.

- b. Include drawings submitted as part of the Shop Drawing package, plus any additional information required to accurately document installed conditions.
- c. Device addresses & IP address information.
- d. Floor plans shall show:
  - 1) Locations and identifiers of all devices.
  - 2) Size, quantity, location, and routes of all pathways (such as cable trays, conduits, J-hangers, and other cable support devices).
- e. Equipment room floor plans scaled at 1/2"=1'-0" showing exact placement of all equipment cabinets/frames, rack bays, and other equipment.
- f. Wall elevations scaled at 1"=1'-0" showing exact placement of all security system hardware (e.g., SECs,).
- g. Installation details

G. Submittal Description: Operation and Maintenance Manuals

- 1. Quantity: Furnish four O & M Manuals.
- 2. Format:
  - a. Furnish each O & M Manual in a white, 3-ring binder with front cover and spine clear pockets for insertion of the project information.
  - b. Clearly label the cover of each O & M Manual with the following information:
    - 1) Client Name
    - 2) Project and Contract Numbers
    - 3) Project Name and Address
    - 4) Manual Name (e.g., "Operation And Maintenance Manual for ACAMS System).
    - 5) Date of Submittal – Format: Month Day, Year (e.g., "January 1, 2010").
    - 6) Contractor Name
  - c. Include a Table Of Contents at the beginning that lists the contents.
  - d. Include tabbed separators for improved navigation through the manual.
- 3. Content:
  - a. Functional Design Manual: Includes a detailed explanation of the operation of the system.
  - b. Hardware Manual which includes:
    - 1) Pictorial parts list and part numbers
    - 2) Pictorial and schematic electrical drawings of wiring systems, including devices, control panels, instrumentation and annunciators
    - 3) Telephone numbers for the authorized parts and service distributors
    - 4) Include all service bulletins
  - c. Operator's Manual which full explains all procedures and instructions for the operation of the system and includes:
    - 1) System start up and shut down procedures
    - 2) Use of system
    - 3) Equipment recovery and restart procedures
    - 4) Reader command functions
  - d. Maintenance:
    - 1) Instructions for routine maintenance listed for each component, and a multi-page summary of all components' routine maintenance requirements.
    - 2) Detailed instructions for repair of the security system

- 3) A summary of the TCP/IP address used and which system component they are associated with. Include the gateway address, subnet mask, DNS server, and host name information
  - e. Warranty: Manufacturer's warranty certificates
  - f. Record Drawings Manual: 11"x17" prints of Record Drawings, as described above.
- H. Resubmittals: Include a cover letter listing the action taken and revisions made to each product submittal in response to Submittal Review Comments. Resubmittal packages will not be reviewed unless accompanied by this cover letter. Failure to include this cover letter will constitute rejection of the resubmittal package.

## **1.06 QUALITY ASSURANCE**

### **A. Contractor Qualifications**

1. Primary business locations from which project management, installation technicians, and service personnel are dispatched must be within 50 miles of the city of San Mateo, to ensure response time for technical assistance within 4 hours.
2. At least 5 years of experience, and a minimum of five satisfactory completed projects similar in scope and cost.
3. Provide a resume of satisfactory evidence of project manager, foreman, and lead technician's qualifications and certifications by the manufacturer for the work.
4. A current AMAG "Global Security Management" Certification indicating that contractor has attended training and successfully completed the training course.
5. A current, active, and valid C7 or C10 California State Contractors License.
6. Authorized reseller/dealer, warranty provider, and a factory certified installer of the AMAG security system at the Global Level.

### **B. Permits and Inspections**

1. Obtain and pay for permits and inspections required for the work.
2. Furnish materials and workmanship for this work in conformance with applicable legal and code requirements.

### **C. Perform tests required herein, or as may be reasonably required to demonstrate conformance with the Specifications or with the requirements of any legal authority having jurisdiction.**

### **D. Obtain review from compliance officials responsible for enforcement of applicable codes and regulations to establish that the work is in compliance with all requirements of reference codes indicated herein.**

### **E. Materials**

1. Provide new and unused materials, equipment, and parts of current manufacturer, and without defects for the units specified herein.
2. Furnish only specified products and equipment, or products and equipment that have been approved in writing.

### **F. Regulatory Requirements**

1. Work and materials shall conform to the latest rules of National Board of Fire Underwriters wherever such standards have been established and shall conform to the regulations of the State Fire Marshal, OSHA and the codes of the governing local municipalities. Nothing in these

specifications is to be construed to permit work not conforming to the most stringent of the applicable codes.

2. Reference to codes, standards, specifications and recommendations of technical societies, trade organizations and governmental agencies shall mean that latest edition of such publications adopted and published prior to submittal of the bid. Consider such codes or standards a part of this Specification as though fully repeated herein.
3. When codes, standards, regulations, etc. allow work of lesser quality or extent than is specified under this series of Sections, nothing in said codes shall be construed or inferred authority for reducing the quality, requirements or extent of the Drawings and Specifications. The Contract Documents address the minimum requirements for construction.

#### **1.07 PROJECT MANAGEMENT AND COORDINATION SERVICES**

- A. Overview: Provide a project manager/engineer for the duration of the project to coordinate the security system work with all other trades. Coordination services, procedures and documentation responsibility shall include, but shall not be limited to the items listed in this section.
  1. Obtain copies of all shop drawings and product data for equipment provided by others that require security connections or interface with the security system work.
  2. Prepare and maintain a shop drawing review log indicating the following information:
    - a. Shop drawing number and brief description of the system/material.
    - b. Date of your review.
    - c. Indication if follow-up coordination is required.
- B. Request for Information (RFI)
  1. Thoroughly review the contract documents prior to the preparation and submission of an RFI. If an RFI is submitted, attach 8 1/2" x 11" copies of all relevant documents to clarify the issue.
  2. Prepare and maintain an RFI log using a Microsoft Excel spreadsheet indicating the following information:
    - a. RFI number and brief summary of the issue
    - b. Date of issuance and receipt of response.
- C. Scheduling of Work
  1. Prepare work schedules for each floor indicating the following information:
    - a. Cable installation dates.
    - b. SEC buildout dates.
    - c. Device installation dates.
    - d. Programming dates.
    - e. Testing dates.
- D. Role of the Engineer
  1. During the construction phase of the project, the Engineer will work with the Contractor to provide interpretation and clarification of project contract documents, reply to (and 'process') relevant Requests for Information (RFIs), and act as an interface between the Contractor and the Owner.
  2. The Owner has retained the Engineer's services to observe the Work for general compliance with the Contract Documents and to ensure that the installation meets the design intent of the system.
  3. In summary, the Engineer will perform the following specific services during the construction phase:



- a. Review product submittals and shop drawings for general compliance with the contract drawings and specifications.
- b. Review changes as they arise, and confirm that the proposed solutions maintain the intended functionality of the system.
- c. Interpret field problems for Owner, and translate into understandable language.
- d. Review the testing procedures to confirm compliance with industry-accepted practices.

#### **1.08 DELIVERY, STORAGE AND HANDLING**

##### **A. Delivery**

1. Do not deliver products to the site until protected storage space is available. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at jobsite.
2. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels (name of the manufacturer, product name, type, grade, UL classification, etc.) intact.
3. Replace materials damaged during shipping at no cost to the Owner.

##### **B. Storage**

1. Store materials in clean, dry, ventilated space free from temperature and humidity conditions (as recommended by manufacturer) and protected from exposure to harmful weather conditions.
2. Comply with manufacturer's requirements for each product. Comply with recommended procedures, precautions or remedies as described in the Material Safety Data Sheets (MSDS) as applicable.
3. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris, and traffic.
4. Storage outdoors covered by rainproof material is not acceptable.
5. Provide heat where required to prevent condensation or temperature related damage.

##### **C. Handling**

1. Handle in accordance with manufacturer's written instructions.
2. Damaged equipment shall not be installed.
3. Replace damaged equipment at no cost to the Owner.
4. Handle with care to prevent internal component damage, breakage, denting, and scoring

#### **1.09 WARRANTY**

- A. Provide a one-year parts and service warranty at no additional cost to the Owner.
- B. Warranty begins when system commissioning is completed, punch list items resolved, and Owner provides in writing acceptance of system.
- C. The warranty package shall include but not necessarily be limited to the following:
  1. Emergency maintenance service on regular working hour basis.
  2. Service by factory trained and employed service representatives of system manufacturer.
- D. Maintain regular service facilities and provide a qualified technician familiar with this work at the site within four (4) hours of receipt of a notice of malfunction including weekends and holidays. Provide material, devices equipment and personnel necessary for repairs. Install approved temporary, alternate

equipment if required by the Owner, complete and operational within twenty-four (24) hours after notification of a malfunction, at no additional cost.

- E. Conduct warranty repairs and service at the job site unless in violation of manufacturer's warranty; in the latter event, provide substitute systems, equipment and/or devices, acceptable to the Owner, for the duration of such off-site repairs. Transport warranty substitute and/or test systems, equipment, devices, material, parts and personnel to and from the job site at no additional cost.

## **PART 2 - PRODUCTS**

NOT USED – REFER TO ADDITIONAL SECURITY SECTIONS FOR PRODUCT DETAIL

## **PART 3 - EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions.
- B. Verify that all penetrating elements and supporting devices have been properly installed, and that all temporary lines, and markings, have been removed.

### **3.02 PREPARATION**

- A. Staffing
  - 1. Provide a qualified foreman in charge of the work at all times and be present at the job site at all times during the installation of the work.
  - 2. Provide a supervised work force capable of performing the installation within the restraints of the construction schedule.
- B. Project Management
  - 1. Prepare an overall construction schedule based on the results of the planning meetings with the Owner.
  - 2. Prepare updated schedules whenever there are modifications. Coordinate and attend weekly status meetings to review the overall progress and issues to be resolved throughout the course of construction. The Contractor is responsible for preparing and distributing meeting agenda prior to and meeting notes after all meetings in a format acceptable to the Owner.

### **3.03 INSTALLATION**

- A. General
  - 1. Perform this work in accordance with acknowledged industry and professional standards and practices and the procedures specified herein.
  - 2. The work shall be performed by skilled installers under the direction of experienced technician, all of whom shall be properly trained and qualified for this work.
  - 3. A complete, operating system shall be provided. Include all devices specified including basic components and accessories, interconnecting wiring and other equipment and installation devices necessary for a complete system as specified.
  - 4. Provide wire, system cabinets, system devices, etc., shall be in accordance with applicable codes for systems as specified. Label all wiring and equipment.

5. The control equipment and wiring shall be installed in a neat and workmanlike manner by trained mechanics or electricians.
  6. Auxiliary and incidental equipment necessary for the operation and protection of the systems specified in this section shall be furnished and installed as if specified in full herein.
  7. Install the Security System with the full support of the manufacturer of the system components.
- B. Coordination
1. Maintain a competent supervisor and supporting technical personnel, acceptable to the Owner during the entire installation. Change of supervisor during the project shall not be acceptable without prior written approval from the Owner.
- C. Boxes, Panels, and Enclosures
1. Install all boxes, panels, and enclosures square and plumb. Set "flush mounted" units so that the face of the cover, bezel or escutcheon shall be in the same plane as the surrounding finished surface. Mount boxes, panels and trim so that there are no gaps, cracks or obvious lines between the trim and the adjacent finished surface and ready them to receive final finish, as applicable.
  2. Install insulating terminations in signal circuit boxes, panels, wireways or enclosures of this section.
  3. Write the destination for every conduit entering a door junction box, SEC enclosure, or wireway using a black permanent ink marker next to the conduit inside the box
  4. Provide tamper switches on all enclosures that are accessible and below the ceiling.
- D. Painting
1. Custom paint devices as indicated on the drawings.

### **3.04 REPAIR/RESTORATION**

- A. Replace or repair work completed by others that you deface or destroy. Pay the full cost of this repair/replacement.
- B. Punch List:
1. Inspect installed work in conjunction with the General Contractor and develop a punch list for items needing correction.
  2. Provide punch list to Owner for review prior to performing punch walk with the Owner.
- C. Re-Installation:
1. Make changes to adjust the system to optimum operation for final use. Make changes to the system such that any defects in workmanship are correct and cables and the associated termination hardware passes the minimum test requirements.
  2. Repair defects prior to system acceptance.

**END OF SECTION**



**SECTION 28 05 13**

**SECURITY SYSTEM CABLING**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. General: Furnish engineering, labor, materials, apparatus, tools, equipment, transportation, temporary construction and special or occasional services as required to make a complete working security system installation, as described in these specifications.
- B. Section Includes:
  - 1. Wiring and cable
- C. Related Sections:
  - 1. Consult other Divisions; determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable system.
  - 2. Section 28 00 00: Basic Security System Requirements
  - 3. Section 28 13 00: Access Control and Alarm Monitoring System
  - 4. Section 28 23 00: Video Surveillance System
  - 5. Section 28 05 53: Security System Labeling
  - 6. Section 28 08 00: Security System Acceptance Testing
  - 7. Section 27 15 13: Telecommunications Horizontal Cabling
  - 8. Section 26 05 00: Electrical General Provisions
- D. Products Furnished and Installed under another Section:
  - 1. Structured network cabling

**1.02 SUBMITTALS**

- A. Comply with Division 1 for procedural, quantity, and format requirements.
- B. Submit in accordance with the requirements of Section 28 00 00: Basic Security System Requirements, the following items:
  - 1. Product Data: including
    - a. Cable Description and Use
    - b. Jacket Rating
    - c. Outside Diameter (of the overall wire or cable)
    - d. Manufacturer
    - e. Part Number

## **PART 2 - PRODUCTS**

### **2.01 WIRE AND CABLE**

#### **A. General**

1. Provide all necessary cable supports and J-Hangers dedicated for security cable
2. Do not share conduits with fire alarm or telecommunications systems
3. Provide required wire and cable sized to allow for voltage drop on long runs and effectively shielded as required to allow the routing of 12 & 24V power and video signal cable in the same conduit without interference or signal noise
4. Cable installed outdoors or in underground conduit must contain a PVC or Polyethylene jacket, flooded to prevent water intrusion.
5. Cables installed outdoors or in underground conduit that transition into the building and run in plenum space to contain a plenum rated (type CMP) jacket and contain water block material to prevent water intrusion.
6. Cables installed indoors to contain a plenum rated jacket (type CMP).

#### **B. Manufacturers:**

1. Westpenn
2. Belden
3. Commscope
4. Or Equal

#### **C. Access Control System**

1. Provide plenum rated cable by Westpenn, Belden, Commscope, or equal.
  - a. #22-4 conductor unshielded: door contacts, glass break detectors, reed detectors
  - b. #16-2 AWG unshielded: low current lock power
  - c. #16-2 AWG unshielded: Lock power from PS-873 to Exit Device (panic hardware)
  - d. #18-2 AWG unshielded: Low current relays and card reader power
  - e. #22/2 pr unshielded: 20mA card reader data.
  - f. #22-8 conductor unshielded: Door Management and Exit Alarms

#### **D. Video Surveillance**

1. Signal: Refer to Telecommunications Specification Section 27 15 13 for IP camera horizontal structured cabling requirements. Horizontal structured cable provided by telecommunications contractor.
2. Power Cable
  - a. Plenum rated
  - b. #18-2 C, unshielded: camera power
  - c. #16-2 C, unshielded: camera power at longer distances
  - d. Manufacturers: Westpenn, Belden, Commscope, or equal

### **2.02 PATCH CORDS AND CROSSCONNECT WIRE**

#### **A. Modular Patch Cords – Type: Data CAT6**

1. Modular patch cords suitable for indoor installation within a telecom room or workstation environment.
2. Cords assembled from a single, continuous length of cordage, homogenous in nature, and terminated at both ends via 8 position modular plugs. Splices are not permitted anywhere.
3. Cordage
  - a. Insulated Conductors: 24 AWG stranded copper, fully insulated with a flame retardant thermoplastic material (such as PVC, or equivalent).
  - b. Twisted Pairs: Two insulated conductors “twisted” into a “pair” (twisted pair), and individually color-coded.
  - c. Unshielded sheath and flame-retardant polyvinyl chloride (PVC) jacketed.
  - d. Flame Rating: NEC CM (or higher) rated, and UL listed as such.
4. Electrical Performance: Comply with TIA/EIA-568-B for CAT6 UTP patch cords and Channel requirements (minimum).
5. Manufacturer:
  - a. Panduit #UTPSP series patch cords

### **2.03 LABELS**

- A. Manufacturer:
  - a. Labels shall be by Brady, Thomas and Betts, or equal.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. Label cables in accordance with Section 28 05 53 – Security System Labeling.
- B. General
  1. Do not run signal wire and cable in parallel to power (120VAC).
  2. Identify all wire and cable clearly with permanent labels wrapped about the full circumference within one (1) inch of each connection. Indicate the number designated on the associated field or shop drawings or run sheet, as applies. Assign wire or cable designations consistently throughout a given system; i.e., each wire or cable shall carry the same labeled designation over its entire run, regardless of intermediate terminations. Additionally, provide labels where wire and cable first enter and exit from conduit, junction or distribution boxes; labels shall be located within six (6) inches of the point of exit. Labels shall be by Brady, Thomas and Betts, or equal.
  3. Secure all wire and cable run vertically in conduit for continuous distances greater than thirty (30) feet at the vertical run terminations. Non-coaxial cables shall be secured by screw-flange nylon cable ties or similar approved devices, Thomas and Betts or equal. Symmetrical clamping devices with split, circular or other wire conforming, nonmetallic bushings shall be provided for all other cables.
  4. Wire and cable shall be continuous and splice-free for the entire length of run between designated connections or terminations.
  5. Make connections to screw-type barrier strips on panels and with insulated crimp-type spade lugs when appropriate. Size lugs properly to assure high electrical integrity, i.e., low resistance connections.

6. Lace, tie or harness wire or cable as required herein, and in accordance with accepted professional practice. Dress, lace or harness all wire and cable to prevent mechanical stress on electrical connections; no wire or cable shall be supported by a connection point.
7. Wiring for shielding certain conductors from others or routing in separate raceways, shall be as recommended by the manufacturer's current requirements.
8. Wiring shall be installed in a continuous steel conduit system when not located above accessible ceiling and shall be of the size recommended by the equipment supplier.
9. Terminate modular patch cord terminated at one end via 8 position modular plug to IP camera. Telecommunications contractor will provide cable and terminate to patch panels.
10. Provide necessary tie wires.
11. Label cables at both ends of a run and within pull and junction boxes using machine generated wrap-around labels.
12. Follow manufacturers recommended guidelines for installation.
13. Utilize the horizontal and vertical management components to properly route the cables and patch cord.

**END OF SECTION**



**SECTION 28 05 53**

**SECURITY SYSTEM LABELING**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. General: Furnish engineering, labor, materials, apparatus, tools, equipment, transportation, temporary construction and special or occasional services as required to make a complete working security system installation, as described in these specifications.
- B. Section Includes:
  - 1. Labeling
- C. Related Sections:
  - 1. Consult other Divisions, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable system.
  - 2. Section 28 00 00: Basic Security System Requirements
  - 3. Section 28 13 00: Access Control & Alarm Monitoring System
  - 4. Section 28 23 00: Video Surveillance System
  - 5. Section 28 05 13: Security System Cabling

**1.02 SUBMITTALS**

- A. Submit in accordance with the requirements of Section 28 00 00: Basic Security System Requirements, the following items:
  - 1. Product Data
  - 2. Label Samples: Submit the following for review and comment prior to the and installation of equipment:
    - a. Enclosure labels.
    - b. Wire and cable labeling detail for all termination points
    - c. Include physical samples of each labeling material.

**PART 2 - PRODUCTS**

**2.01 LABELS**

- A. Phenolic two tone for exterior mounting on Enclosures. White lettering on black background.
- B. Wire and Cable labels:
  - 1. Provide self-laminating adhesive laser labels.
  - 2. Labels shall be machine printable with a laser printer.
  - 3. Text Attributes:
    - a. Black

- b. 1/8" high, minimum, or #12 font size
- c. Font: Verdana preferred, SansSerif, or Arial acceptable
4. Printable area: 1.0" X .375" and 1.0" X 0.50".
5. Cable size: 0.16 – 0.32" OD
6. Color: White
7. Manufacturer:
  - a. Brady wire marking labels WML-211-295 and WML-311-292.
  - b. Thomas and Betts
  - c. Or Equal

### **PART 3 - EXECUTION**

#### **3.01 INSTALLATION**

- A. Label all wiring and equipment.
- B. Identify wire and cable clearly with permanent labels wrapped about the full circumference within one (1) inch of each connection. Indicate the number designated on the associated field or shop drawings or run sheet, as applies. Assign wire or cable designations consistently throughout a given system; i.e., each wire or cable shall carry the same labeled designation over its entire run, regardless of intermediate terminations. Additionally, provide labels where wire and cable first enter and exit from conduit, junction or distribution boxes; labels shall be located within six (6) inches of the point of exit.
- C. Label all cables at both ends of a run and within all pull and junction boxes using machine generated wrap-around labels.
- D. Boxes, Panels, and Enclosures
  1. Write the destination for every conduit entering a door junction box, SEC enclosure, or wireway using a black permanent ink marker next to the conduit inside the box.
  2. Install approved labels on the outside of each SEC and relay termination enclosures.

#### **3.02 LABELING**

- A. General Requirements
  1. Physically label all of the security system components. The components include, but are not limited to, the following:
    - a. Enclosures
    - b. Cables (both ends)
    - c. Terminal blocks
    - d. Relays
    - e. Patch panels, and the termination positions within the patch panels.
  2. The ends of all cables must be permanently marked with machine-generated or stenciled (not handwritten) wrap around labels with a self-laminating feature, according to current practice and as approved by Owner before installation.
  3. Components, such as racks and patch panels, must be permanently marked with machine-generated labels, according to current practices and as approved by the Owner before installation.
  4. Labels shall coincide with device id's use on the record drawings.

B. Equipment Enclosures

1. Label all Enclosures, alarm monitoring, and powers supply enclosures associated with the security system with an adhesive backed phenolic label. Use 12 point text.
2. Labels shall be represented in and match the security system record drawings.

C. Security Devices

1. Label all equipment associated with the security system with a permanent machine generated, laminated, label. Use 12 point text with a clear background. Use white or black lettering depending upon the color of the device.
2. Label device in a concealed location with the system point number and address.
3. Label power supply batteries with the month and year they were installed.

D. Wire and Cable

1. Label all wire and cable associated with the security system with permanent machine generated, laminated, labels. Use 12 point, black text on a white label.
2. All wire and cable labels shall be clearly visible without the need to remove wire management or any other obstructions.

E. Cable Label Format

1. Obtain label format document from District or use the following:
2. From Panel to Field Device
  - a. Line 1: Device Type and Device Number
  - b. Line 2: Panel ID – Port Number
  - c. Example: CR 001  
ACU 1 – KP5
  - d. Standard Device Types  
KP = Keypad  
R = Relay Output  
A = Alarm Point
  - e. Standard Port #  
M = Monitored Input  
R = Relay Output
3. Miscellaneous Examples:
  - a. From Panel to Door Contact  
A001  
D.C.
4. Communications Cable
  - a. Line 1: Communication Type and Direction
  - b. Line 2: Panel ID
  - c. Example: 20MA TO  
ACU 2
  - d. Typical Communication Types  
10BASE-T  
RS485  
RS 232  
RS 422  
20mA

**END OF SECTION**

**SECTION 28 08 00**

**SECURITY SYSTEM ACCEPTANCE TESTING**

**PART 1 - GENERAL**

**1.01 SCOPE OF WORK**

- A. General: Provide all engineering, labor, materials, apparatus, tools, equipment, and transportation required to test a completed security system installation as described in these specifications.
- B. Base Bid Work
  - 1. Full testing of completed security system which includes:
    - a. Complete pretest of the security system
    - b. Submittal of pre-testing documentation reflecting 100% pass or successful operation
    - c. Submittal of As-Built drawings prior to final walk test with Engineer and/or Owner
    - d. Final walk test with the Owner
    - e. Test Results Record Documentation
- C. Related Sections:
  - 1. Consult all other Divisions, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to test a complete and operable system.
  - 2. Section 28 00 00: Basic Security System Requirements.
  - 3. Section 28 05 53: Security System Labeling
  - 4. Section 28 05 13: Security System Cabling
  - 5. Section 28 13 00: Access Control and Alarm Monitoring System (ACAMS)
  - 6. Section 28 23 00: Video Surveillance System

**1.02 SUMMARY OF TESTING ACTIVITIES**

- A. Overview
  - 1. The purpose of system acceptance testing is to ensure the security system operates properly. Security systems are very complex from both equipment and programming standpoint, and thorough testing is necessary to ensure correct operation.
  - 2. Perform testing activities when the system is “quiet” and the building is generally unoccupied. This will minimize the amount of irrelevant activity in the system activity reports that will be used as a record of the pre and final test results.
- B. Pre-Test
  - 1. Perform a 100% pre-test of all system aspects to verify correct operation prior to scheduling the final test. The pre-test will help to make the final test run smoothly when demonstrating the system’s operation to the Owner.
  - 2. Document the results of the pre-test using the approved test forms and submit a copy to the Owner along with the system activity reports

C. Final Test

1. Perform a final test of the system in the presence of the Owner to demonstrate correct operation of the security system.

**1.03 SUBMITTALS**

A. Submit in accordance with the requirements of Section 28 00 00: Basic Security System Requirements, the following items:

1. Sample Test forms
  - a. Provide sample test forms that will be used in the pre and final system tests. Furnish the required quantity of each submittal indicated in Division 1.
2. Operation and Maintenance Manuals: Submit the following for review and comment at the completion of the project and before final testing occurs:
  - a. Functional Design Manual: Includes a detailed explanation of the operation of the system
  - b. Hardware Manual
    - 1) Pictorial parts list and part numbers
    - 2) Pictorial and schematic electrical drawings of wiring systems, including devices, control panels, instrumentation and annunciators
    - 3) Telephone numbers for the authorized parts and service distributors
    - 4) Include service bulletins
  - c. Software Manual which includes
    - 1) Use of system and applications software
    - 2) Initialization, start-up, and shut down procedures
    - 3) Alarm Reports
  - d. Operator's Manual which full explains all procedures and instructions for the operation of the system and includes:
    - 1) Computers and peripherals
    - 2) System start up and shut down procedures
    - 3) Use of system, command, and applications software
    - 4) Recovery and restart procedures
    - 5) System access requirements
  - e. Maintenance Manual
    - 1) Instructions for routine maintenance listed for each component, and a multi-page summary of component's routine maintenance requirements.
    - 2) Detailed instructions for repair of the security system.
    - 3) A summary of the software licenses, including license numbers, quantity of clients, summary of the software options provided and database capabilities.
  - f. Test Results Manual, which includes the document results of all tests, required under this Specification, organized by System, Floor, and Door.
  - g. As-Built Drawings
3. Record Drawings:
  - a. Drawings to fully represent installed conditions including actual locations of devices, actual cable and terminal block numbering, and correct wire sizing as well as routing. Record changes in the work during the course of construction on blue or black line prints.
  - b. Include drawings submitted as part of the Shop Drawing package, plus additional information required to accurately document installed conditions.

- c. Include the following additional information:
  - 1) Device addresses & IP address information.
  - 2) Settings for each camera (lens specs, mm setting, auto shutter setting, and other available camera settings, etc.)
- d. Final acceptance will not be made until the Engineer approves the record drawings.

#### **1.04 QUALITY ASSURANCE**

- A. Complete testing work in a neat, high quality manner acceptable to the Owner.
- B. A project manager shall coordinate the acceptance testing work with all other trades.

#### **PART 2 - PRODUCTS**

NOT USED

#### **PART 3 - EXECUTION**

##### **3.01 SCHEDULING**

- A. Prepare a schedule for testing activities based on the schedule developed in Section 28 00 00. Prepare updated schedules whenever there are modifications.

##### **3.02 TESTING REQUIREMENTS**

###### **A. Site Tests**

- 1. Perform a 100% pretest of the system prior to final testing by the Owner. Provide the Owner with a minimum of a 5-day notice prior to scheduling testing.
- 2. At the conclusion of the work on a floor, test the system on that floor to verify proper operation and reporting of devices.
- 3. Work with the door hardware supplier to resolve any electric hardware failures and door alignment/closure problems.
- 4. At the completion of all work, test the entire system to verify proper operation. These tests shall include:
  - a. Card Reader Door Test: Test doors to ensure alarm contact provide alarm activation and relock when closed, rex shunts door and command card reader bypasses alarm inputs for area when applicable.
  - b. RS232 Modem Dialup Test: Test modem functionality for alarms to District Headend. Disconnect network at panel and initiate panel alarm. Modem should dial and connect to head end. Confirm activity at head end workstation
  - c. Access Control: Test the software for correct programming and setup to activate door schedules, elevator interface and test cards.
  - d. CCTV Recording System Test: Test the recording system for correct programming, scheduled alarm recording, and event retrieval. Test and verify CCTV system viewable from workstations.
  - e. CCTV Camera Test: Review cameras for proper coverage, quality of video, focus, etc. Verify proper installation and mounting.

- f. CCTV Integration Test: Verify correct integration with the ACAMS system for alarm call-up. Test each alarm tied to VSS. Triggering alarms such as a duress button should call up alarm event information and associated video clip on video monitoring workstation.
- g. CCTV Workstation Test: Test existing workstation ability to view live and recorded video on each campus. Verify workstation can view cameras on associated campus. Verify District office can view cameras from each of the three campuses.
- h. Security Equipment Room Test: Inspect all system panels, power supplies, and other related security equipment located in these areas.

**B. Test Preparation**

- 1. Provide device identification numbers that differ from or were not included on the original contract drawing set.
- 2. Provide a complete systems point list.
- 3. Provide paper and toner for the printer so that an event log can be printed out and attached to the test reports as verification of test sequence and systems response.
- 4. During testing, provide a minimum of two technicians familiar with the installation to assist with the test. Stage the technicians as follows: one at the host and one at the device being tested.
- 5. Furnish radios for use by the Owner during testing.
- 6. Furnish pre-programmed access cards for use during testing. One card shall be provided for each access level.

**3.03 TEST PROCEDURES**

- A. Prepare and issue for review test forms for each door and device type.

**3.04 DOCUMENTATION**

- A. Provide a full-sized drawing containing a detailed wiring diagram (layout of equipment/elevation, complete parts list, and a complete wiring diagram for each ACU & I/O Board) for each SEC. Fold the diagram and place it inside a clear plastic pocket affixed to the inside door of the SEC.
- B. Provide a service log on the inside door of each SEC. Service log shall include columns for the following information: date of service, description of work performed, service technician(s), and service company. Place the service log inside a separate clear plastic pocket affixed to the inside door of the SEC.

**3.05 DEMONSTRATION**

- A. On completion of the acceptance test and Owner programming, provide the Owner instruction in the operation and testing of the system, at a time convenient to them.
- B. Utilize the database for the project during training to give the users a project specific example to learn from.



- C. Provide a minimum of [8] hours of on-site training for the both the ACAMS and Video Surveillance System by a factory-trained representative. Conduct separate training sessions for system administrator, system supervisor, and operator level users
  1. Maintain a sign in sheet with names and dates of all persons trained and forward to Owner upon completion of training.

**END OF SECTION**



**SECTION 28 13 00**

**ACCESS CONTROL & ALARM MONITORING SYSTEM (ACAMS)**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Provide engineering, labor, materials, apparatus, tools, equipment, transportation, temporary construction and special or occasional services as required to make a complete working Access Control and Alarm Monitoring System (ACAMS) installation, as described in these specifications.
- B. Section Includes:
  - 1. Access control and alarm monitoring, including access control units, input/output units, card readers, door contacts, rex detectors and door management alarms, and gals break detectors
  - 2. Interface to electric door hardware
  - 3. ACAMS Power supplies
  - 4. Lock Power Supplies
  - 5. Interface to central station alarm monitoring.
- C. Products Specified but not Installed under this Section:
  - 1. Type 1 enclosures at pull box locations
- D. Products Furnished and Installed under another Section:
  - 1. Data cable to network port and Local Area Network (LAN)
  - 2. Voice cable and connections to District
  - 3. 120V power to system
  - 4. Electrified locking hardware
- E. Related Sections:
  - 1. Consult other Divisions; determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable system.
  - 2. Section 08 71 00 Door Hardware: includes product information for electrified locking hardware and magnetic door holders.
  - 3. Section 28 00 00 Basic Security Requirements: includes general project requirements, submittal formats, warranty, and installation requirements and additional sections for reference.
  - 4. Section 28 05 13 Security System Cabling: includes product information for wire and cable needed to support the ACAMS.
  - 5. Section 28 05 53 Security System Labeling: includes label types and formats for security devices.
  - 6. Section 28 08 00 Security System Acceptance Testing: includes testing requirements for ACAMS.
  - 7. Section 28 23 00 Video Surveillance System: includes product information for video integration with the ACAMS.

## 1.02 SYSTEM DESCRIPTION

### A. Overview

1. Refer to Division 1 and Section 280000 for general description

### B. Access Control & Alarm Monitoring System (ACAMS)

1. The ACAMS will control access control into the building as indicated on the plans. Intrusion alarm monitoring, comprised of door contacts, is consolidated to the ACAMS eliminating the need for a conventional burglar alarm panel.
2. Provide ACAMS panel in Building 30 capable of supporting the two access controlled doors.
3. Select exterior card readers shall be proximity "Command Card" readers and allow select cardholders to execute preprogrammed commands from the reader numerical keypad. For this scope of work program commands to arm/disarm the door contacts and interior intrusion devices for each space the card reader gains access to with either card plus key command or just key command.
4. Connect the ACAMS to the District's existing head end utilizing the LAN/WAN and secondary redundant RS232 communications over modems in the event network failure occurs. The first panel in the hub cluster will connect to the network switch located in the building.
5. Program conditional commands to output ASCII data to alarm translator/dialer for connection to central station alarm monitoring company. Meet with District to determine unique grouping requirements.

### C. Custom Device Requirements

1. Connect all low voltage cables between lock power supplies, transfer hinges, and locks.

### D. Tamper Monitoring

1. Provide additional monitor input points for monitoring the following:
  - a. Tamper switches located within each security equipment enclosure and wire way
  - b. Supervision of power supplies and batteries.

## 1.03 SUBMITTALS

- A. Contractor Qualifications: Submit certification letters for the manufacturer of the ACAMS.
- B. Product Data: Submit product information for components specified herein. Refer to Section 280000 for format and requirements.
- C. Shop Drawings: Submit shop drawings in accordance with Division 1. Refer to Section 280000 for format and requirements.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

#### A. Access Control and Alarm Monitoring System

1. The ACAMS system is manufactured by Group 4 Technologies AMAG. Pursuant to Section 3400 of the Public Contract Code: AMAG Access Control and Alarm Monitoring System is now in use on the particular public improvement described as San Mateo County Community College District. At each instance in these specifications that "AMAG" is designated by brand name, said manufacturer's system is required and is designated to coordinate with existing systems that are

in place at Skyline College, College of San Mateo, Cañada College and the District Administration Building. The Contractor will furnish and install only “AMAG” systems and devices as required, and no substitutions shall be deemed to be “or equal” or allowed.

- B. Card Readers
  - 1. AMAG Technology, Inc
- C. Power Supplies
  - 1. Altronix
- D. Intrusion Devices
  - 1. GE Security
  - 2. Detection Systems (DSI)

## **2.02 ACCESS CONTROLLERS**

- A. General: 8-door controller capable of expanding to 16 with modular additions, including battery backup, database, user defined reports, and several communication ports. Controller shall serve as a consolidation and control point for all security related field devices including card readers, lock control, elevator control, and intrusion detection devices. Specifically the core functions of the controller are as follows.
  - 1. Central control for devices attached.
  - 2. Makes decisions for access without reliance on communications to host or other field panel
  - 3. Executes scheduled events such as unlocking doors or bypassing alarms.
  - 4. Responds to monitor activity.
  - 5. Receives input to control its decision-making.
  - 6. Reports activity to other devices
  - 7. Can support multiple reader technologies
  - 8. Incorporates Flash Memory for remote upgrades or enhancements to firmware
  - 9. Provides communications in multiple formats to downstream panels or Host Software
- B. District Standard Configuration
  - 1. Enclosure – UL listed Cab 4 enclosure with internal 12VDC charge card and battery backup and external transformer. Note plug-in transformers will not be used and a hardwired consolidated transformer specified later will be used to power up to 3 controllers
  - 2. Components
    - a. DBU – fitted with Network Interface Module for TCP/IP communications and integral RS232 communications to fall back on dial-up modem communications.
    - b. (1) 4DCU
    - c. (1) I/O modules
- C. Capacities:
  - 1. Card Readers: Standard configuration includes 8 cabled to and terminated in main controller enclosure. Controller is expandable to 16 with modular units connected to main database unit.
  - 2. Monitor Inputs: Standard configuration includes 32 inputs in main controller, expandable to 96 when including modular controllers.

3. Relay outputs: 16 standard expandable to 32.
  4. Card Holders: 20,000
  5. Elevator Control configuration allows for a single card reader connected with 32 floor control.
- D. Mounting: Provide in its own enclosure as a complete UL assembly with power supply.
- E. Power:
1. Source: Power is provided via unshielded twisted pair wiring from an external transformer and internal 12VDC charge card and 7.0 AMP Hour Battery.
  2. Power only the controller components and card readers from control panel power supply.
  3. Power all other devices including additional door furniture, locks, intrusion devices, and auxiliary relays from power supplies designated as such and specified herein.
  4. DBU Battery: A low voltage battery (such as a lithium cell) shall maintain the internally stored database setup when no power is available to the controller
- F. Communications
1. TCP/IP or Dial-up Communications from 1st panel on chain to host
  2. 20 MA secure bi-directional to downstream panels in chain
  3. 20 MA to card readers
- G. Self-protection: The Controller shall have inputs to detect:
1. Power input failures
  2. Controller tampering
- H. Manufacturer: AMAG Technologies M2100 and other multiNODE series controllers

### **2.03 MONITOR INPUT/RELAY OUTPUT BOARDS**

- A. General: Module that monitors inputs and provides relay outputs
- B. Capacities:
1. Monitor Inputs: 8 four-state supervision monitor points.
  2. Relay Outputs: 4 Normally Open (NO) or Normally Closed (NC) Form C.
- C. Mounting: Plug in (piggyback) to door control units.
- D. Manufacturer:
1. AMAG Technologies – I/O module

### **2.04 NETWORK/COMMUNICATION INTERFACE DEVICES**

- A. TCP/IP 10/100BASE-TX Connection
- B. Any communications that must be achieved for the first panel other than direct connection to District WAN must be reviewed and approved by the District and the Engineer
- C. Automatic fail over to RS232 dial up communications for alarm routing to host

D. Manufacturer:

1. AMAG Technologies Network Interface Module

**2.05 CARD READERS**

A. General

1. Wire readers back to the Controller directly. Do not daisy chain readers together.
2. Presenting a card to the reader shall initiate a single read. Thereafter the card must be removed from the reader's field and re-presented before it is again read by the system.
3. Coordinate specific reader types to be used below with district prior to ordering.
4. Integral LED to indicate the status of the door and an audible indicator. The LED status shall be as follows:
  - a. Red steady indicates reader is powered up
  - b. Red flash after card presentation indicates card has been read but access is denied
  - c. Green Momentary indicates card is valid and access is granted
  - d. Green Steady indicates door is unlocked indefinitely on schedule.
5. Provide with an internal tamper switch that will indicate an alarm condition if an unauthorized attempt is made to disassemble the unit.
6. Provide units capable of communicating in 20 MA bi-directional supervised protocol.

B. Exterior Perimeter Mullion Readers

1. Read Range: 2.5 inches (typical)
2. Operating Voltage: 9-14 VDC

C. Manufacturer:

1. AMAG Technology #S830 Micro Proximity Reader, black (or color to match mounting surface)

D. Interior Prox+Pin Command Card Readers

1. Read Range: 5 inches (typical)
2. Operating Voltage: 9-14 VDC.
3. Additional LEDS indicating card command and alarm armed status
  - a. Card Commands programmed from system head end and software based.
4. Manufacturer:
  - a. AMAG Technology Keypad Proximity, Ash Gray or best color to match mounting surface

**2.06 REQUEST TO EXIT (REX) SENSORS**

A. General

1. Mount REX detector directly to top jamb of doors above recessed contacts.
2. Aim detection pattern directly down in front of door plane to minimize pedestrian circumventing
3. Minimize relay pulse time to 1 second and allow controller to determine bypass time.
4. Wire REX cables directly back to controller.
5. Terminate signal to REX input on controller
6. Power REX detector from auxiliary 12VDC device power supply.

B. Manufacturer:

1. Detection Systems DS161, Black or DS160, White, (or color to best match mounting surface)

**2.07 DOOR CONTACTS**

A. General

1. Install door contacts flush in top jamb or side jamb of door near top corner
2. Align magnet with door contact
3. Report fire rated assemblies not factory prepped to general contractor to coordinate and acceptable solution
4. Wire contact cables directly back and terminate to controller
5. Closed-loop, 1/2" gap

B. Manufacturer, or equal:

1. Sentrol 1076 1" recessed contacts, mahogany

**2.08 TRANSFORMERS**

A. General

1. Transformer shall convert 120/240V AC power to 12/24 Volts AC
2. Hardwire transformer to electrical junction box (plug-in transformers are not acceptable)
3. Transformer must be rated to power three ACAMS controllers and not shared with other device power requirements

B. Manufacturer: AMAG XFMR

**2.09 POWER SUPPLIES/BATTERY CHARGERS**

A. Control Panel Power Supply

1. Integral to AMAG Controller Assembly. Connect to ACME transformer.

B. Lock/Relay Power Supplies

1. 120V hardwired input.
2. 6 AMP continuous 24VDC supply
3. Alarm output for AC fail and low battery; connect to alarm inputs on ACAMS control panel.
4. Integral Isolation relays with 8 access control input triggers and 8 independently controlled and configured outputs
  - a. Dry outputs for triggers to PS-873 power supply at exit device doors
  - b. Wet 24VDC to low current locks
  - c. Wet 24VDC to power control relays in elevator demarcation enclosure.
5. Interconnect all card reader outputs (8) in a one to one relationship to inputs (8) on power supply.
6. Switching lock load through Access Control Panel relays is unacceptable
7. Do not use for devices other than locks and control relays.
8. Manufacturer: Altronix AL600ULACM



C. Device Power Supplies

1. 120V hardwired input.
2. 4 AMP continuous @ 12VDC.
3. Alarm output for AC fail and low battery; connect to alarm inputs on ACAMS control panel.
4. Do not power locks from power supply
5. Manufacturer: Altronix AL400ULM

**2.10 TYPE 1 PULL BOXES/JUNCTION BOXES**

A. Provide 24"x24"x6.62" type 1 lockable enclosure at locations shown on plans

B. Pull Boxes do not require back panel

C. Elevator junction boxes require back panel and the following components fabricated to panel

1. 24VDC low current double pole double throw form c equipment isolation relays
2. Configure each relay for independent control of either floor select buttons Elevator 1 or hall call buttons Elevator 2 and powered from the lock power supplies located in the SEC
3. Provide terminal strip on panel for landing outputs from relays on one side and interconnecting elevator cables on other side
4. Provide tamper alarm in enclosures and terminate to ACAMS panel.

D. Manufacturer:

1. Hoffman Type 1 Enclosure A-2420ALP; Panel A2420MP; Cylinder Lock Kit A-L12AR

**2.11 MODEM**

A. Provide 56K dialup modem and connect to 1<sup>st</sup> panel in SEC

B. Modem provides dial up communications if network is unavailable

C. Install modem in separate communications enclosure with network outlet

D. Manufacturer

1. US robotics, Black Box, Approved Equal

**PART 3 - EXECUTION**

**3.01 INSTALLATION**

A. Control Equipment Installation

1. Coordinate installation of equipment with other trades to avoid unforeseen conflict.
2. Install supervisory and end of line resistors as required
3. Interconnect all access control panels, lock power supplies and device power supplies with rigid conduit and screw cover raceway (gutter) to protect cables through out.
4. Hardwire power supplies with electrical conduit fittings and junction boxes, plug in transformers and exposed cable is unacceptable.
5. Coordinate network connection with Telecom contractor inside access controller enclosure.

6. Coordinate IP address with District IT staff.
  7. Coordinate Voice connection with District IT department.
- B. Field Devices
1. Install devices as indicated on drawings.
  2. Provide conduit and/or other approved pathways (such as cable hangers) to house cables. Provide surface raceways to devices when concealment of EMT conduit is not possible
    - a. Exception: long multiple cable pathways routing to pull boxes or homeruns.
  3. Use conduit pathways and fish cable as required to final device locations including using storefront mullion as raceways.
  4. Homerun cables from field devices to control panel within approved pathways.
- C. Locking and ADA Hardware
1. Coordinate the installation and termination of the security cable with the installation of the electric door hardware and transfer hinge provided under Division 8.
  2. Connect and configure access control system integration to ADA operator as indicated in drawings. Reconfigure if required to meet sequence of operation for door. Coordinate with door contractor for equipment terminations.

### **3.02 PROGRAMMING**

- A. Prior to the completion of construction, schedule a meeting with the Owner and the Engineer to determine the programming criteria and access to District head end. Discuss the following:
1. Door Names
  2. Device Names
  3. Alarm groups
  4. Schedules and time codes
  5. Action/responses from individual input points
  6. Action response from card and keypad commands
  7. Alarms tagged for routing ASCII data to existing alarm dialer.
- B. Document the results of the meeting and perform necessary programming to achieve the Owner's requests.
- C. Program the system such that reliance on a remote host for routine building operations, such as scheduled door commands and conditional events, are minimized to the greatest extent possible and decisions are made at the local building controller.
- D. Program the system in a manner that minimizes the amount of time required for the users to make updates and maintain the system on a daily basis especially updates that impact card holder record updates. Nested programs, such as reader groupings used in access codes shall be used to the greatest extent possible such that single actions are required to update an entire card data population. If there is a question regarding the appropriate approach to programming, given the flexibility of most systems, contact the Engineer prior to any initial programming.
- E. Program and setup all system hardware such that no additional programming other than entering new access cards, time codes, and access adding doors to existing access privilege groups is required. Programming shall include the setup of available features of the software.

**END OF SECTION**



**SECTION 28 23 00**

**VIDEO SURVEILLANCE SYSTEM**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Provide engineering, labor, materials, apparatus, tools, equipment, transportation, temporary construction, and special or occasional services as required to make a complete working video surveillance system installation, as described in this specification.
- B. Section Includes:
  - 1. CCTV Monitoring and Recording System
  - 2. CCTV IP fixed and PTZ cameras, lens, mounts, and housings
  - 3. CCTV power supplies
  - 4. Integration with ACAMS
  - 5. Interfaces and connections to District security LAN/WAN to allow remote viewing over network
- C. Products Supplied But Not Installed Under This Section:
  - 1. None
- D. Products Installed But Not Supplied Under This Section:
  - 1. None
- E. Products Specified But Not Installed Under This Section:
  - 1. None
- F. Products Furnished and Installed under another Section:
  - 1. 120VAC power
  - 2. Network (Ethernet) cable for IP cameras
  - 3. Owner provided PoE switches in the telecommunication rack for CCTV connectivity via security LAN/WAN
  - 4. Network for signal transport to video storage servers, IP video encoders, and video monitoring workstation connectivity
- G. Related Sections:
  - 1. Consult other Divisions; determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete and operable system.
  - 2. Section 28 00 00 Basic Security Requirements: includes general project requirements, submittal formats, warranty, and installation requirements and additional sections for reference.
  - 3. Section 28 05 13 Security System Cabling: includes product information for wire and cable needed to support the ACAMS.
  - 4. Section 28 05 53 Security System Labeling: includes label types and formats for security devices.

5. Section 28 08 00 Security System Acceptance Testing: includes testing requirements for the video surveillance system.
6. Section 28 13 00 Access Control & Alarm Monitoring System: includes product information for video integration with the ACAMS.
7. Section 27 15 13 Telecommunications Horizontal Cabling: includes product information for cable needed to support Video Surveillance System IP devices.

## **1.02 DEFINITIONS**

- A. Refer to Division 1 and section 280000 for additional definitions.
- B. In addition, the following list of terms as used in this specification defined as follows:
  1. "NAS": Network Attached Storage
  2. "NVR": Network Video Recorder
  3. "PTZ": Pan-Tilt-Zoom
  4. "PoE": Power-over-Ethernet
  5. "VMS": Video Management System

## **1.03 SYSTEM DESCRIPTION**

- A. Overview
  1. Refer to Division 1 and Section 28 00 00 for general description
  2. The video surveillance system is an extension to the overall security management system that includes access control and alarm monitoring (ACAMS) and mechanical keying.
  3. Provide pathways to connect camera locations to existing primary security infrastructure.
  4. Provide a fully functioning Video Surveillance System and extension of the existing network-based recording system with capacity to store recorded footage for a minimum of 30 days.
  5. Utilize existing security network for IP video transport to existing centralized VMS.
- B. Video Surveillance System
  1. The video surveillance system consist of IP fixed position, 360 degree field-of-view cameras connected to Owner provided security PoE switch located in the telecommunication rack. These connect to existing network video servers that manage and store IP video streams over the dedicated security LAN on each campus.
  2. Assess the existing NVR servers to determine additional camera capacity and storage. Notify the Owner when an additional server is required.
  3. Provide appropriate number of video licenses with 1-year software support for additional cameras connected to the exacqVision system through the security LAN, IP video server devices, or existing DVRs.
  4. Coordinate network connections to IP cameras with the District's IT department prior to installation. Provide one security network connection for each device.
  5. Provide CCTV cameras as indicated on the floor plans. Use megapixel cameras at exterior locations viewing large assembly size spaces or interior locations viewing large lobbies. Include environmental housing with heater and blower for cameras located outdoors.
  6. Utilize PoE switches for camera power and connection to VMS.

7. Provide 360 degree IP CCTV cameras as indicated on the floor plans to with capability to view around the building. Include environmental housing with heater and blower for cameras located outdoors. Camera power home runs on low voltage cable back to power supplies.
8. Power exterior IP cameras locally from CCTV power supplies located within 50 feet of the camera. Size power supplies accordingly for voltage loss and power demands for outdoor rated enclosures with heater and blower options included.
9. Provide CCTV camera power supplies located adjacent to ACAMS power supplies.
10. Provide day/night cameras in outdoor locations with low light levels.
11. Provide appropriate lens as indicated on plans to establish correct field of view. Field verify exact lens settings on each camera for clear picture during both day and night.
12. Program integration to District's AMAG access control system as follows:
  - a. Program video servers for recording based on ACAMS alarm events such as door alarms or duress button activation. Recorded video will reference associated alarm information and video monitoring workstation(s) will display recorded video clip automatically.
  - b. Setup IP camera's built-in video motion detection when ACAMS alarms are not available.
  - c. Review alarm integration and workstation configuration with the District during the programming meeting. Set quality of recorded video to maximum setting at 10 frames per second minimum during an alarm condition. Some cameras may require recording frame rates of 30 frames per second such as license plate capture cameras. Verify special function camera recording frame rates with the District.

**C. Tamper Monitoring**

1. Provide additional monitor input points for monitoring the following:
  - a. Tamper switches located within each security equipment enclosure and wire way
  - b. Supervision of power supplies and batteries

**1.04 SUBMITTALS**

- A. Product Data: Submit product information for components specified herein. Refer to Section 28 00 00 for format and requirements.
- B. Shop Drawings: Submit shop drawings in accordance with Division 1. Refer to Section 28 00 00 for format and additional requirements. Include the following.
  1. Device placement on floor plans
  2. Point-to-Point Diagrams: Include wiring, points of connection and interconnecting devices between the following:
    - a. Video surveillance system, monitors, and recording equipment
    - b. Devices connected to the system
    - c. Miscellaneous control relays
    - d. Conductors (identify conductors on the point-to-point diagrams with the same tag as the installed conductor)
  3. Block Diagram/Riser Diagram: Show the video surveillance system components, conduit, wire types, and sizes between them, including cabling interties between termination hardware.
  4. Custom mounting details

### **1.05 WARRANTY**

- A. Digital Video Recording System: Provide a manufacturer's warranty covering repair or replacement of defective parts for a period of three years from the date of shipment from the factory
- B. Cameras and Support Devices: Provide a manufacturer's warranty covering repair or replacement of defective parts for a period of one year from the date of shipment from the factory.

## **PART 2 - PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Digital Video Recording System
  - 1. The video surveillance recording software manufactured by exacq Technologies.
  - 2. The system must be compatible with the Districts existing exacqVision video surveillance headend and AMAG access control and alarm monitoring headend.
  - 3. The video storage server hardware must be capable of handling video surveillance system software and network video.
- B. IP Cameras
  - 1. Axis Communications
  - 2. Arecont Vision
  - 3. Sony
  - 4. Or Equal
- C. Analog Cameras
  - 1. Pelco
  - 2. Panasonic
- D. Power Supplies
  - 1. Pelco
  - 2. Axis
  - 3. Altronix

### **2.02 CAMERA SYSTEM**

- A. General
  - 1. Type: Color, solid-state CCD with DSP technology, unless otherwise noted
  - 2. Power: 24 VAC/VDC
  - 3. Imager: 1/3 inch format, unless otherwise noted
  - 4. Lens Mount: Accept a "CS" mount auto or manual-iris lens
  - 5. Synch: Adjustable line lock for synchronizing camera to power line. No auxiliary sync cable required.
  - 6. Resolution: 640x480 minimum resolution, unless otherwise noted
  - 7. Minimum Light Level: 0.1 fc imager illumination at full video, unless otherwise noted



8. Lens: Field determine, unless otherwise noted
  9. Video transmission through IP signal or analog signal to IP encoder
- B. Fixed IP 360° Exterior Megapixel Dome Cameras
1. Unit containing:
    - a. Four 2 megapixel image sensor, or higher quality with progressive scan
    - b. Resolution: 22 frames per second minimum at 1600x1200 and 30 frames per second at 640x480
    - c. Video streaming: Simultaneous Motion JPEG and H.264
    - d. Auto iris, varifocal lens, UON
    - e. Security: IP address filtering and HTTPS encryption
    - f. Power over Ethernet (IEEE 802.3af), Class 1
    - g. Connectors:
      - 1) Ethernet 10/100 BaseT, RJ-45
      - 2) Terminal block for alarm inputs, output, and RS-485/422
      - 3) Power - Mini DC
    - h. IR cut filter
    - i. Outdoor IP66 rated housing
  2. Manufacturer:
    - a. Arecont Vision #AV8365DN fixed 360°dome camera
    - b. Or equal
  3. Accessories:
    - a. Arecon Vision corner mount adapter #MD-CRMA
    - b. Arecont Vision mounting plate #MV-EBA, or pendant kit #SV-CMT
    - c. Or equal

### 2.03 CAMERA LENSES

- A. General
1. Built from the finest optics available for use on a CCTV surveillance type camera.
  2. Contain integral intraspot filters
  3. Format to match CCD imager
  4. Variable focus, refer to plans for approximate range of lens
  5. Auto-iris connector coordinated with the camera type (i.e., 4-pin vs. 6-pin)
  6. CS type mount
  7. Manufacturers:
    - a. Pelco
      - 1) #13VDIR7.5-50 - 1/3" CS-Mount 7.5-50mm Day Night
      - 2) #13VD1-3 - 1/3" CS-Mount 1.6-3.4mm Wide Angle
    - b. Panasonic
      - 1) #PLZ15/33 - 1/3" CS-Mount 15-50mm, F=1.5
      - 2) #PLA22T3DN - 1/3" CS-Mount 2.2mm, F=1.2 Wide Angle
    - c. Rainbow

- d. Sony
- e. Or Equal

## **2.04 CAMERA MOUNTS AND HOUSINGS**

- A. Exterior Dome
  - 1. AXIS, see Camera Systems for options
  - 2. Arecont Vision, see Camera Systems for options
  - 3. Or Owner Approved Equal
  - 4. Housing: Integrated heater and blower
- B. Wall Mounted
  - 1. Mount: Pelco SWM Series
  - 2. Arecont Vision, see Camera Systems for options
  - 3. Mount: AXIS #25736 Gooseneck

## **2.05 POWER SUPPLIES/BATTERY CHARGERS**

- A. CCTV System Power Supplies
  - 1. 120 VAC input to 24 VAC output, continuous current, fully supervised power supplies for power to cameras.
  - 2. Provide a separate fused connection to power supply per camera.
  - 3. Interior Fixed or PTZ Camera
    - a. Manufacturer: Pelco #MSC-16-10SB UL listed power supply/batter charger for indoor use
    - b. Altronix
    - c. Or equal
  - 4. Exterior PTZ Camera
    - a. Pelco #WCS 1-4 NEMA4X/IP66 rated for outdoor use
    - b. AXIS #5000-001 24VAC Outdoor power supply
    - c. Altronix
    - d. Or equal

## **2.06 CCTV LIGHTNING PROTECTORS**

- A. Data Line Protectors
  - 1. Provide on data lines serving exterior IP cameras.
  - 2. Manufacturer:
    - a. PolyPhaser Corp # NX4-60-IG
    - b. DITEK
    - c. Or equal
- B. Power Line Protectors
  - 1. Provide on power lines serving exterior cameras.

2. Manufacturer:
  - a. PolyPhaser Corp #IS-SPTV
  - b. DITEK
  - c. Or equal

### **PART 3 - EXECUTION**

#### **3.01 INSTALLATION**

##### **A. CCTV Cameras**

1. Provide outdoor housing and mounts for exterior cameras.
2. Field determine exact placement of cameras to ensure complete coverage.
3. Coordinate location with obstructions such as columns or exceedingly high shelving units to avoid concealment opportunity.
4. Field determine fixed camera lens size to ensure complete coverage. Refer to plans for lens selection starting point.
5. Route watertight flex from junction box to camera housing from below on exterior cameras.
6. Provide 25 foot cable loop at PTZ location for relocating unit if required post installation
7. Provide 12 foot cable loop at interior camera locations installed in accessible ceiling location for future Owner relocation of unit if required post installation
8. Coordinate network connection with Telecom contractor for each IP Camera.
9. Coordinate camera IP address with District IT staff.
10. Coordinate programming of IP cameras into existing video surveillance head end with District and Districts contracted AMAG programmer.

##### **B. Exterior Cameras**

1. Installation requirements under paragraph A, CCTV Cameras still apply.
2. Provide waterproofing material and required gaskets in order to maintain roofing or wall system warranty. Verify installation does not void roofing or wall assembly warranty.
3. Provide lightning protection on cameras located on or near roof tops and parapets.

##### **C. CCTV Power supplies**

1. Do not combine with Access Control & Alarm Monitoring System power supplies.
2. Locate power according to security drawings.

##### **D. Surge Protection**

1. Provide surge protection for video, power, and control cable on exterior cameras.
2. Provide protective device at the camera and encoder/recorder device.

##### **E. Pathways**

1. Provide conduit and back boxes to devices located on walls and inaccessible ceilings.
2. Route device conduit back to security equipment hub.
3. Provide back boxes for all devices installed in ceiling and support brackets that span T-Bar grid.

4. Route cable on dedicated J-hanger runs attached to structure above. Do not attach cable to ceiling grid hangers.
5. Coordinate fiber optic cable requirements with telecommunications.
6. Coordinate joint trenching with telecommunications and/or electrical for site pathways.

### **3.02 PROGRAMMING AND TRAINING**

- A. Prior to the completion of construction schedule a meeting with the Owner, Engineer, and Owner's AMAG programmer to determine the programming criteria. Discuss the following:
  1. Camera naming
  2. PTZ Presets
  3. Schedules and recording parameters including quality and frame rate (including video motion detection)
  4. ACAMS alarm and event integration requirements for workstation pop-ups and recording.
  5. Video archiving schedule
  6. Live viewing requirements
  7. AMAG workstation user levels for defining which levels have access to specific ACAMS and video surveillance features
- B. Document the results of the meeting and perform necessary programming to achieve the Owner's requests.
- C. Setup and program the cameras such that no additional programming required. Programming at the head end performed by Owner's AMAG programmer.
- D. Use the camera naming convention agreed upon in the programming meeting when programming point names into the system.
- E. In addition to training requirements indicated in Section 28 08 00, provide 2 hours of training on all programming requirements listed above. Provide training as required to give users the ability to administer and troubleshoot system errors.

### **3.03 TESTING**

- A. Test the video surveillance system in accordance with Section 28 08 00.

**END OF SECTION**

**SECTION 28 31 00**

**FIRE DETECTION AND ALARM SYSTEM**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section Includes: A Protected Premises Fire Detection system for San Mateo County Community College District Cañada College. Modifications to the existing fire alarm system shall provide evacuation alarm tone signaling using horns to sound the alarm signals and ADA-compliant strobe notification devices for visual notification. The system shall be intelligent device addressable, analog detecting, low voltage and modular, with digital communication techniques, in full compliance with all applicable codes and standards. The system provided shall have a Fire Alarm Control Panel (FACP) and field devices as indicated on the DSA-approved Drawings.
1. The features and capacities described in this specification are a requirement for this project and shall be furnished by the successful contractor. The District has determined that the Siemens MXL system, supplied and installed by Siemens Building Technologies, Hayward, CA (contact Kelly Rogers: 510-783-6000), is the District standard, no equal. The system as described in this specification and as shown on the Drawings shall be installed, programmed, tested, and delivered to the owner in fully operational condition. The system shall include all required hardware, software, raceways and interconnecting wiring to accomplish the requirements of this specification and the Contract Drawings, whether or not specifically itemized herein. The system shall consist of, but not be limited to, the following:
    - a. Fire Alarm Control Panel (FACP).
    - b. Fire Alarm Remote Annunciator (FAAP), as indicated on the Drawings.
    - c. Booster Power Supplies, as required, for notification devices.
    - d. Addressable Manual Fire Alarm Pull Stations.
    - e. Addressable Analog Smoke Detectors
    - f. Addressable Area Heat Detectors.
    - g. Addressable Analog Duct Smoke Detectors.
    - h. Addressable Intelligent Interface Modules.
    - i. Audible and Visual Notification Appliances.
  2. Non-addressable alarm initiating, supervisory and status monitored devices shall be integrated into the fire alarm system, as applicable, via an addressable intelligent interface module, as indicated on the Drawings:
    - a. Sprinkler Water Flow Alarm (alarm initiating).
    - b. Sprinkler Valve Tamper Switch (supervisory).
    - c. PIV, OS&Y.
    - d. Kitchen Ansul Systems.
    - e. Security Interface.
    - f. Magnetic hold-opens.
  3. Connections to existing elevator control panels (by others) and providing the necessary modules for elevator recall and shunt trip functionality.
  4. Audible/visual notification appliances and communicating devices to be controlled by the FACP:
    - a. Horns.
    - b. Strobe Lights.
    - c. Combination Horn/Strobes.
    - d. Bells.
  5. Connect system to the existing campus MXL network system such that all status changes are transmitted to the Main Campus FACP.

6. DSA and local requirements shall be adhered to with regard to submitting Specifications, wiring diagrams, shop drawings and plans. Responsibility for furnishing the quantities of copies in digital format and/or hard copy, as directed by contract requirements, shall be included as part of the work of this Section.
  
- B. Related Work: The Contractor shall coordinate work described within this section with all related trades and shall relay all necessary coordination information to the System Supplier in a timely manner such that proper coordination shall take place. Work and/or equipment provided in other sections and related to the fire alarm system shall include, but not be limited to:
  1. Mechanical Coordination: Sprinkler water flow alarm and valve tamper switches to be provided and installed by the fire protection sprinkler contractor, if a part of this project. See Division 22. They shall be wired and connected to the fire alarm system monitor modules by the Contractor.
  2. Mechanical Coordination: Duct Smoke Detectors shall be provided and wired under this Section and installed under the mechanical section as shown on the fire alarm system drawings.
  3. Security Interface, if required.
  4. Coordinate with all other trade contractors for the mounting of and/or interfacing with any and all other fire alarm system related devices.
  
- C. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
  
- D. Related Sections
  1. Document 00 11 19 - Instructions to Bidders: For instructions to Bidders.
  2. Section 01 32 19 - Submittal Procedures: For submittal procedures.
  3. Division 01 - General Requirements: For general requirements of the Contract.
  4. Division 22 - Plumbing: For plumbing requirements.

## **1.02 REFERENCES - APPLICABLE LISTINGS, CODES, STANDARDS, DOCUMENTS**

- A. Standards and Codes
  1. All equipment shall be installed and comply with the current adopted provisions of the following codes and standards.
  2. All equipment shall be Underwriters' Laboratories (UL), Inc. listed for its intended use. At a minimum, the following standards shall apply:
    - a. UL 268 and 268A - Smoke Detectors for Fire Protective Signaling Systems.
    - b. UL 346 - Water-Flow Indicators for Fire Protective Signaling Systems.
    - c. UL 464 - Audible Signaling Appliances.
    - d. UL 864 - Control Units for Fire Protective Signaling Systems.
    - e. UL 1481 - Power Supplies for Fire Protective Signaling Systems.
    - f. UL 1971 - Signaling Devices for the Hearing-Impaired.
  3. National Fire Protection Association (NFPA) standards:
    - a. NFPA No. 13 - 1999 Edition - Sprinkler Alarm and Supervision.
    - b. NFPA No. 70 National Electrical Code.
    - c. NFPA No. 72 National Fire Alarm Code.
    - d. NFPA No. 90A Installation of Air Conditioning & Ventilating Systems.
    - e. NFPA No. 101 Life Safety Code.
  4. All raceways and wiring shall be installed in compliance with NFPA Standard 70 (National Electrical Code - Article 760) with applicable California amendments. Codes shall be implicitly followed, in particular, with regard to material type and quality, circuitry extensions from and connections to outlet and junction boxes, panel boards and similar appurtenances.
  5. The fire alarm system and its installation shall comply with all applicable requirements of the Americans with Disabilities Act of 1992.

6. The fire alarm system and its installation shall comply with DSA and all other local codes and authorities having jurisdiction, including but not limited to, San Mateo County Community College District's engineering design standards and guidelines.

### **1.03 SYSTEM DESCRIPTION**

#### **A. Performance Requirements**

1. The system shall operate as an integrated, multiplexed, protected premises fire alarm control system tied into the existing campus network system.
2. Changes in the status of monitored points shall be detected by the microprocessor based fire alarm control panel and shall report any change in status to the Main Campus Fire Alarm System utilizing Cañada College networking protocol.
3. Sensor "dirty" and "excessively dirty" trouble conditions shall report automatically.
4. Devices shall be listed by UL for sensitivity testing by means of the portable programmer/tester or by readout from the control panel. Each addressable device address shall be set electronically, devices requiring dipswitch settings, rotary switch settings, staples or jumper settings are not acceptable.
5. Smoke detectors shall alarm at their programmed sensitivity settings and shall not revert to a common default setting when their operating system segment is in the fail safe degrade mode.
6. System shall individually identify each addressable initiating device and other addressable monitor functions using multiplexing interfacing techniques.
7. System shall be capable of operating each alarm notification appliance, and other control functions, using multiplexing techniques.
8. Life safety alarm function programs shall perform automatically upon system alarm actuation. In addition, control points may be operated manually at any time by the attendant through appropriate keyboard commands. The FACP shall also provide integral programmable function control switches to allow personnel to manually operate specific pre-programmed control output functions, as required.

### **1.04 SUBMITTALS**

- A. Prior to the start of work, the Contractor shall provide a complete and comprehensive submittal for review by the Engineer. These are to describe the proposed system and its equipment. Failure to provide a complete submittal shall be grounds for summary rejection of any incomplete submittal documentation. District reserves the right to deduct monies from payments due Contractor to cover District and Architect/Engineer's additional costs of review beyond the second submission. The complete submittal shall include, but not be limited to, all of the following material:
  1. Power Calculations
    - a. Battery capacity calculations shall be a minimum of 125 percent of the calculated requirement.
    - b. Supervisory power requirements for all equipment.
    - c. Alarm power requirements for all equipment.
    - d. Power supply rating justification showing power requirements for each of the system power supplies. Power supplies shall be sized to furnish the total connected load in a worst case condition plus 25 percent spare capacity.
    - e. Voltage-drop calculations for wiring runs demonstrating worst-case condition.
  2. Complete manufacturers catalog data including supervisory power usage, alarm power usage, physical dimensions, finish and mounting requirements.
  3. Complete Drawings covering the following shall be submitted by the Contractor for the proposed system. Floor plans in the current AutoCAD version showing the locations of all equipment and raceways, conductor counts with type and size.
  4. A complete proposed system database including a description of all logic strings, control by event programming and point identification labels on a unique CD-ROM and in a formatted printed form, as required for off site editing, shall be submitted for evaluation by the owner.

- a. The program shall include all required interactive control functions between the local network systems and the methods for implementing these actions.
5. Provide the address, telephone number, and contact person(s) of the manufacturer's local service facility for normal and off-hour warranty issues.
6. Provide a fire alarm system function matrix. Matrix shall illustrate alarm output events in association with initiating devices input events. Matrix shall represent a summary of the installed system alarm, supervisory and trouble functions. (See Appendix-A NFPA-72 for minimum matrix requirements - A-7-5.2.2 (9) 1999).
7. For each system control and/or power panel, provide panel ampere loading during both normal and alarm modes, with time calculations to substantiate compliance with battery back-up power requirements (battery Ampere-Hour capacity), described elsewhere in these Specifications.
8. For each system control panel, provide written schedule of active and spare addresses provided on each addressable circuit to substantiate compliance with circuit usage/spare requirements, described elsewhere in these Specifications.
9. For each system control panel and system transponder notification appliance circuit, provide proof of spare capability in amperes available for future use, if needed.
10. Provide manufacture's printed product data, catalog pages and descriptions of any special installation requirements and/or procedures. Drawings depicting any special physical installation requirements shall show physical plans, elevations, all dimensions, conduit entry, minimum access clearances and any other details required.
11. Provide shop drawings as follows:
  - a. Drawing or catalog page showing actual dimensions of the main FACP.
  - b. Drawing(s) or catalog page(s) showing actual dimensions of any additional system control panels and/or battery cabinets.
  - c. Drawing or catalog page showing actual dimensions of the Remote Annunciator.
  - d. Single line riser diagram showing, all equipment, all connections and number and size of all conductors and conduits.
  - e. Provide samples of various items when so requested by the Architect/Engineer.

#### **1.05 QUALITY ASSURANCE**

- A. It is the intent of these Specifications to provide a complete fire alarm system that complies in all respects with the requirements of all applicable codes and standards. Equipment, materials, software, installation practices, etc. that do not meet these requirements or do not meet the performance standards herein specified shall not be acceptable.
- B. The equipment furnished under this specification shall be that of the specified manufacturer, no equal. All information herein is intended to establish minimum standards of performance, quality and construction, and is based upon the Siemens MXL addressable analog equipment designed and manufactured by Siemens Building Technologies, Inc. Catalog and model numbers are specified herein and indicate the materials as well as the operating features required. It is not the intent of these Specifications to eliminate competitive installation proposals, only to standardize the District's Fire Life Safety Systems.
- C. Before commencing work the fire protection contractor shall submit data showing that contractor has successfully installed fire alarm systems of the same scope, type and design as specified. The contractor shall also include the names and locations of at least three installations where such systems have performed satisfactorily for the preceding 18 months.
  1. The Contractor shall submit copies of all required Licenses and Bonds as required by the State.
  2. The system supplier shall employ on staff a minimum of one NICET level 4 personnel or a professional engineer, registered in the State of California.
  3. Installing contractors unable to comply with the provisions of 1.06 shall present proof of engaging the services of a subcontractor qualified to furnish the required services.



- D. Provide the services of a representative or technician from Siemens Building Technologies. The representative or technician is to be certified and experienced in the installation and operation of the type of system specified. The representative shall be licensed in the State, if required by law. The fire alarm contractor shall supervise installation (duct detector locations are to be determined by the mechanical contractor). The system supplier shall provide all software programming, software documentation, system adjustments, preliminary testing, final testing and certification of the system. The fire alarm supplier shall also be required to provide a 4 hour operational instruction to the owner's personnel.
- E. All fire alarm system equipment furnished under this specification shall be UL listed, under the appropriate category, as the product of a single manufacturer. All control equipment shall be listed under UL as a single control unit. The manufacturer shall have been engaged in the production of this type of equipment for at least ten (10) years and have a fully equipped service organization capable of responding within 48 hours from the initial contact for warranty or regular service work. Emergency and/or off hours calls shall be responded to within 4 hours of initial contact, seven days a week.
- F. Prior to bid submittal, per Document 00 11 19, Contractor shall state what, if any, specific points of the proposed system's operation or the equipment's quality differ in any way from this specification by submission of a complete technical proposal to include supporting literature and Drawings. Only those departures from these Specifications, submitted in writing per the requirements of Document 00 11 19, shall be considered by the engineer. Failure to submit all departures from these Specifications in compliance with Document 00 11 19, and to receive approval for such departures, shall be cause for summary rejection of any submittal documents where unapproved departures are discovered.
- G. Should conflicts arise between project Drawings and/or these Specifications, regarding design, quantities of devices or circuits, the higher standard and/or quantity and/or cost shall be considered correct.
- H. It is the Contractor's responsibility to submit acceptable equipment for review by the engineer. The Contractor shall bear all liability for damages arising from his failure to submit equipment that meets these Specifications, including, but not limited to, any penalties for failure to meet construction deadline.
- I. Final determination of compliance with these Specifications shall rest with the Engineer of Record, who, at its discretion, may require proof of performance at the cost of the Contractor. Required proof may include, but shall not be limited to, expense paid visits by representatives of the owner and engineer to sites where identical equipment is installed and providing beneficial use.

#### **1.06 PROJECT CONDITIONS**

- A. Existing Conditions
  - 1. This project consists of modifying the existing fire alarm system within the existing building. The Contractor shall visit the site to determine and verify all existing conditions. Existing conditions that would, in the Contractor's opinion, prohibit or greatly delay construction progress shall be brought to the Architect and Engineer's attention in writing in a timely manner.
  - 2. No additional compensation shall be permitted for variations due to accessible field conditions that would affect the installation of the fire alarm system.

## **PART 2 - PRODUCTS**

### **2.01 BASIC SYSTEM EQUIPMENT, CIRCUITING, ADDRESSING AND OPERATING CAPABILITIES**

#### **A. General**

1. The FACP shall communicate via an RS-485 Carrier Sense, Multiple Access, Collision Detect protocol, also known as CSMA/CD or an ETHERNET type topology.
2. The FACP shall provide NFPA 72, Style 4 (Class B) analog signaling line circuits. Each loop card shall communicate with and receive alarms from up to 120 points, consisting of a maximum of sixty intelligent analog alarm initiating and sixty intelligent controllable output devices. Circuits shall be configured with loop isolators and wired in a manner that prevents a catastrophic wiring event on a floor from affecting the performance of other floors.
3. Remote Annunciator (Siemens RCC Series): LCD type with two lines of 40 characters each. The Remote Annunciator shall communicate to the FACP on one #16 TSP and derive power from the FACP over a pair of #14 AWG conductors. It shall be possible to Acknowledge general "ALARM", "TROUBLE", and "SUPERVISORY" conditions from the Remote Annunciator using a key. Each Remote Annunciator must be housed in a lockable box. NEMA rated boxes are required for any locations, interior or exterior, where adverse weather or high humidity conditions occur. Mount Remote Annunciator(s) as indicated on the Drawings, at a height where reasonable viewing is possible by the responding fire authority. Obtain approval of the specific location from the Architect and/or Engineer of Record prior to mounting the Annunciator.
4. System power supplies, including necessary Booster Power Supplies, transformers rectifiers, regulators, filters and surge protection required for system operation, with the capacity to power the system in a worst case condition with all devices in alarm and all local indicating appliances active without exceeding the listed ratings. Provide adequate notification appliance Booster Power Supplies so as to allow for a minimum of 20 percent spare capacity on each NAC.
  - a. System primary power: Primary power for the FACP and the secondary power battery chargers shall be obtained from a dedicated emergency power circuit. Circuit breakers shall be fitted with a suitable guard, requiring removal of a screw to open, and used only for fire alarm. Each circuit used for fire alarm purposes shall be permanently labeled for function.
  - b. Secondary power supply: Provide sealed gelled electrolyte batteries as the secondary power supply for all fire alarm functions. The battery supply shall be calculated to operate loads in a supervisory mode for twenty-four (24) hours no primary power applied and after that time, operate in alarm mode for five (5) minutes. Batteries shall be sized at 125 percent of the calculated size to compensate for deterioration and aging during the battery life cycle. Battery calculations shall be submitted to justify the battery size.
5. The system 16 bit core processor shall incorporate an internal operating system to process incoming alarm signals and issue output commands required as a result of the alarm reception, by system programming or by manual commands. All system processors shall be supervised by individual watchdog circuitry furnishing automatic restart after loss of activity. Systems with single watchdog circuits for all processors shall not be acceptable unless supplied with a "hot" standby CPU. Digital communication capabilities required for the control panel to communicate with remote annunciators, input/output drivers and displays shall be provided.
6. Manual Addressable Pull Stations (Siemens MSI-10B) shall be the single action type, unless specifically noted otherwise by these Specifications or on project Drawings, and listed by Underwriters' Laboratories, Inc. The intelligent manual fire station shall operate on any addressable detection circuit. It shall be red in color. Manual fire stations shall be individually annunciated on the control panel. Mounting height shall be 48 inches to the manual station actuation handle from the finished floor.
7. Intelligent/analog smoke detectors (Siemens FP-11) shall be photoelectric and listed by Underwriters' Laboratories, Inc. The detector shall contain a long life light emitting diode (LED) as its light source, and photo diode as a light receiver. An automatic gain control circuit shall be

- compensating for detector aging and dirt accumulation. The smoke detector shall be a plug-in twist/lock unit that allows for easy connection to its mounting base. Each smoke detector, when activated, shall have a flashing tri-color LED alarm indicator that shall indicate red for alarm, yellow for trouble and green for normal operational mode. Application Specific Detection environmental settings shall be programmed as directed by the engineer. System programming shall provide multiple output functions from a single initiating multi-criteria smoke detector. This capability shall mean a separate alarm event output for smoke alarm and a separate alarm output function for thermal alarm from a single analog initiating address device. Systems not capable of providing this design requirement shall provide alternate programmable logic accomplishing design performance, acceptable to the Engineer of Record.
- a. It shall be possible to adjust and/or electronically measure the sensitivity of each individual intelligent analog smoke sensor from the control panel. Relative sensitivity or manual test methods, which check the smoke sensor at the maximum allowable obscuration, will not be considered as being equivalent.
  - b. Smoke detectors shall alarm at their programmed sensitivity settings and shall not revert to a common default setting when their operating system segment is in the fail safe degrade mode.
8. Intelligent/Analog Duct Smoke Detector (Siemens FP-11/AD2-XHR, or ILP-1/AD-3ILP for rooftop applications) shall be photoelectric and listed by Underwriters' Laboratories, Inc. The detector shall contain a long life light emitting diode (LED) as its light source, and photo diode as a light receiver. An automatic gain control circuit shall be compensating for detector aging and dirt accumulation. The smoke detector shall be a plug-in twist/lock unit that allows for easy connection to its mounting base. Each smoke detector, when activated, shall have a flashing tri-color LED alarm indicator that shall indicate red for alarm, yellow for trouble and green for normal operational mode. Application Specific Detection environmental settings shall be programmed as directed by the Engineer. System programming shall provide multiple out-put functions from a single initiating multi-criteria smoke detector. This capability shall mean a separate alarm event output for smoke alarm and a separate alarm output function for thermal alarm from a single analog initiating address device. Systems not capable of providing this design requirement shall provide alternate programmable logic accomplishing design performance, acceptable to the Engineer of Record.
- a. It shall be possible to adjust and/or electronically measure the sensitivity of each individual intelligent analog smoke sensor from the control panel. Relative sensitivity or manual test methods, which check the smoke sensor at the maximum allowable obscuration, will not be considered as being equivalent.
  - b. Smoke detectors shall alarm at their programmed sensitivity settings and shall not revert to a common default setting when their operating system segment is in the fail safe degrade mode.
  - c. Coordinate sampling tube sizing with mechanical ducting requirements prior to shipping.
9. Heat detectors (Siemens FPT-11) shall be 135° F fixed temperature or fixed temperature/rate of rise and be listed by Underwriters' Laboratories, Inc. Rate-of-rise alarm threshold rate shall be 15° F per minute with a maximum coverage area of 2,500 sq. ft. Activation of the rate-of-rise heat detector shall be self-restoring. All detectors shall be addressable and have a white finish. The thermal detectors shall be individually annunciated on the control panel. Each heat detector, when activated, shall have a flashing tri-color LED alarm indicator that shall indicate red for alarm, yellow for trouble and green for normal operational mode.
10. High temperature heat detectors (Siemens DT-200R) shall be conventional 200° R fixed temperature/rate compensated and listed by Underwriters' Laboratories, Inc. The detector shall have a maximum coverage area of 2,500 sq. ft. Upon activation, the detector shall latch in alarm until reset at the main fire control panel and be self-restoring. The detector shall be individually annunciated at the control panel by means of interfacing with a remote addressable monitor module (TRI Series) or an addressable conventional zone module (CZM-4). The detector's interface module address shall be set by electronic means only, no mechanical means such as programming pins, dip-switches or rotary dials shall be used.

11. Interface modules (Siemens TRI Series) shall be intelligent and listed by Underwriters' Laboratories, Inc. The unit shall incorporate a custom microprocessor based integrated circuit that provides communication with main fire control panel. The interface module shall supervise and monitor normally open or normally closed dry contacts and report their status to the control panel. The intelligent interface module shall be used to uniquely identify field devices (contacts) such as kitchen ansul, suppression system, water flow switches, tamper switches, OS&Y valves or as directed by these Specifications and project Drawings.
12. Intelligent interface modules (TRI-R) shall also be used when remote relays are required for system control functions, such as, but not limited to, fan shut down, door holder trip and elevator recall and shunt trip functions. Relay dry contacts shall be rated at 4 AMPS, 120 VAC resistive or 30 VDC resistive and contacts shall be Form "C" type.
13. The MXL and Booster Power Supplies shall provide NFPA 72, Style Y, two-wire (Class B), notification appliance circuits.
14. Horns (Wheelock AH Series) shall be installed as shown on the Drawings in accordance with the requirements of the UL 1971 standard and NFPA 72. Provide UL listed weatherproof units and their required back boxes where shown on the Drawings.
15. Horn Strobes (Wheelock Z-Series) shall be installed as shown on the Drawings in accordance with the requirements of the UL 1971 standard and NFPA 72. Provide UL listed weatherproof units and their required back boxes where shown on the Drawings. See Strobe requirements below.
16. Strobes (Wheelock Z-Series) shall be installed as shown on the Drawings in accordance with the requirements of the UL 1971 standard and NFPA 72. Where multiple visual notification appliances can be seen from any location, circuitry shall be incorporated for the synchronization of flash rate. Strobes shall be of the latest compatible Siemens appliances. See DSA approved Drawings for device quantities and locations. Provide UL listed weatherproof units and their required back boxes where shown on the Drawings.
  - a. Strobes shall produce a flash rate of one (1) flash per second minimum over the listed input voltage (20VDC - 31VDC) range.
  - b. Strobes shall incorporate a Xenon flashtube enclosed in a rugged Lexan lens or equivalent with solid state circuitry.
  - c. Strobe intensity shall be rated per UL 1971 for 15/75, 30/75, 60/75, 75 or 110 Candela. Dual listing strobes of 15/75 intensity for UL 1971/near-axis requirements shall be used where acceptable.
  - d. Strobes shall be available for semi-flush or surface mounting and in conjunction with audible appliances as required.
17. Magnetic Door Hold-Opens (Rixen FM-998) shall be of the wall mount type and capable of operating at three voltages, 120VAC, 24VDC AND 24VAC, shall be provided under this section. They shall operate using local 24VDC power. The power shall be intercepted by a fire alarm system addressable control module or a relay base detector in order to interrupt the circuit so that the door closes in a fail-safe manner. See DSA approved Drawings for device quantities and locations.
18. Software and firmware control:
  - a. All software and firmware provided with a fire alarm system shall be listed for use with the fire alarm control unit.
  - b. A record of installed software and firmware version numbers shall be maintained at the location of the fire alarm control unit.
  - c. All software and firmware shall be protected from unauthorized changes through the use of "access levels."

## **2.02 SYSTEM ALARM OPERATION**

- A. Activation of any addressable manual fire pull box, area smoke detector, heat detector or waterflow switch shall result in, at a minimum, the following functions and indications:

1. Activate "ALARM" status change at the local FACP and annunciate on its LCD display, indicating device address, device type, device location, time and date.
  2. Indicate "ALARM" status change at the respective building Remote Annunciator indicating device address, device type, device location, time and date.
  3. Activate General "ALARM" status change at the Off-Site Monitoring Station, through the Campus Network System.
  4. Activate emergency evacuation audible and visual notification appliances within the associated building(s).
  5. Annunciate "ALARM" status change at the On-site Main Campus Fire Alarm Control Panel location.
  6. Record event in the non-volatile system historical log.
  7. Record event system status change on the Main Campus Printer.
- B. Elevator Recall:
1. Activation of smoke detector in an Elevator Lobby (other than the Lobby designated "Primary Recall Floor) Machine Room or Elevator Shaft shall cause the associated elevator(s) to be recalled to the designated Primary Recall Floor.
  2. Activation of the Lobby Smoke detector on the designated Primary Recall Floor shall cause the associated elevators to be recalled to the designated Secondary Recall Floor.
  3. Activation of any Elevator Machine Room heat detector shall shunt trip the respective elevator main breaker.

### **2.03 SYSTEM SUPERVISORY FUNCTIONS**

- A. Activation of any Supervisory circuit, (i.e.; duct detector, supervised fire sprinkler valve closure, fire suppression system air pressure abnormal, low temperature, fire pump trouble, emergency fuel tank level alarm, as applicable to this project), shall cause the following actions and indications:
1. Activate "SUPERVISORY" status change at the FACP and annunciate on its LCD display, indicating device address, device type, device location, time and date.
  2. Indicate "SUPERVISORY" status change at the respective building Remote Annunciator indicating device address, device type, device location, time and date.
  3. Activate General "SUPERVISORY" status change at the Off-Site Monitoring Station, through the Campus Network System.
  4. Annunciate "SUPERVISORY" status change at the On-site Main Campus Fire Alarm Control Panel location.
  5. Record event in the non-volatile system historical log.
  6. Record event system status change on the Main Campus Printer location.

### **2.04 SYSTEM TROUBLE FUNCTIONS**

- A. Receipt of a system trouble alarm, shall cause the following actions and indications:
1. Activate "TROUBLE" status change at the FACP and annunciate on its LCD display, indicating device address, device type, device location, time and date.
  2. Indicate "TROUBLE" status change at the respective building Remote Annunciator indicating device address, device type, device location, time and date.
  3. Activate General "TROUBLE" status change at the Off-Site Monitoring Station, through the Campus Network System.
  4. Annunciate "TROUBLE" status change at the On-site Main Campus Fire Alarm Control Panel location.
  5. Record event in the non-volatile system historical log.
  6. Record event system status change on the Main Campus Printer location.
- B. The fire alarm system wiring shall be electrically supervised to automatically detect and report trouble conditions to the FACP.

- C. System addressable devices shall be supervised for placement and normal operation. Removal of an addressable device or the failure of its internal electronic circuitry shall initiate a system trouble condition.
- D. The FACP shall initiate a system trouble condition when the following occurs:
  - 1. Primary 120/220 VAC power loss.
  - 2. Battery disconnect.
  - 3. Battery low voltage.
  - 4. LCD annunciator panel power loss.
- E. Operating an Off-Site Station agency alarm disconnect switch or any manual control commands that alter the system from its normal programmed standby configuration shall initiate a trouble condition.
- F. Trouble conditions shall automatically activate an audible signal and flash the general system trouble LED indicator at the FACP. Pressing the trouble acknowledge key on the FACP shall silence the audible signal and continuously light the LED indicator, until the trouble condition is repaired. Subsequent trouble conditions shall re-sound the audible signal and again flash the LED. Each trouble condition must be individually acknowledged.
- G. Removal of or failure of internal electronic circuitry of any addressable device shall initiate a system trouble condition.

## **2.05 INSTALLATION SHOP/AS-BUILT DRAWINGS**

- A. Show general layout of complete system including equipment arrangement. It shall be the responsibility of the fire alarm installing contractor to verify dimensions and ensure compatibility of all system interfaces. Shop drawings shall be maintained at the job site and shall be updated on an as needed basis. During the project life cycle, the Architect/Engineer may require updated drawings as reference during scheduled project meetings.
  - 1. Identify on the drawings, conduit and conductor sizes and types with number of conductors in each conduit. Provide each conduit and device with a unique identification. For addressable alarm initiation devices, the system identifier shall be the system address for that device. Signals shall be sequentially numbered with the address of the associated control module.
- B. As-built drawings shall indicate point to point wiring diagrams of interconnecting wiring within all system control panels and termination enclosures showing wiring between modules and connecting field device terminals. All field numbering and/or labeling shall be reflected on As-built drawings.
- C. Provide mounting details of FACP, remote transponder control panels (if any), system terminal enclosures and other boxes to building structure, showing fastener type, sizes, material and embedded depth.

## **2.06 CONDUIT, BOXES, ENCLOSURES AND WIRING DEVICES**

- A. All system wiring shall be in conduit and shall comply with all applicable article of the current California-amended NEC edition.
- B. Boxes shall be installed plumb and firmly in position.
- C. Extension rings with blank covers shall be installed on junction boxes where required.
- D. Junction boxes served by concealed conduit shall be flush mounted.

- E. Upon initial installation, all wiring outlets, junction, pull and outlet boxes shall have dust covers. Dust covers shall not be removed until wiring installation when permanent dust covers or devices are installed.
- F. All junction boxes shall be painted fire department red and be affixed with a decal or silk-screened label "Fire Alarm System."
- G. Wet or damp locations shall require a NEMA rated enclosure suitable for the environment in which an addressable field device or module are to be installed. (i.e. monitoring of sprinkler water flow, tamper switches and OS&Y valves).
- H. Electrical conduits shall enter only at the side or the bottom of control cabinets, unless designed and approved for entry on the top.
- I. All conduits shall be grounded to a water main by approved ground clamps with a conductor equal in size to the largest conductor used in the system; but in no case shall the ground conductor be smaller than no. 10 AWG.
- J. All openings in fire rated walls, floors or ceilings where conduits, cables or wiring trays pass through shall be fire stopped with an approved fireproofing material rated to meet or exceed the rating of the assembly penetrated.

## **2.07 CONDUCTORS**

- A. Each conductor shall be identified as shown on the Drawings at each with wire markers at terminal points. Attach permanent wire markers within 2 inches of the wire termination. Marker legends shall be visible.
- B. All wiring shall be supplied and installed in compliance with the requirements of the National Electric Code, NFPA 70, Article 760, and that of the manufacturer-wiring guides.
- C. Wiring for analog loop circuits, conventional detection circuits, speaker circuits and telephone circuits shall be based on the fire alarm manufacturer's wiring guidelines, but shall not be smaller than #16 AWG.
- D. Notification Device Circuits: Minimum wire size shall be 12 AWG for horn and strobe circuits.
- E. Splices shall be made with UL listed mechanical connectors to assure reliable service.
- F. Crimp-on type spade lugs shall be used for terminations of stranded conductors to binder screw or stud type terminals. Spade lugs shall have upset legs and insulation sleeves sized for the conductors.
- G. Wire nuts or other solderless splicing devices shall not be used.
- H. A consistent color code for fire alarm system conductors throughout the installation shall be provided. The installation contractor shall submit for approval prior to installation of wire, a proposed color code for system conductors to allow rapid identification of circuit types.
- I. All nominal voltage branch circuit power feeds (120/220 VAC) shall be identified "labeled" at both ends of the circuit to indicate its source and purpose. Each FACP and control panels shall have a dedicated branch circuit with shunt trip disconnect, labeled as such.
- J. Wiring within system control panels shall be arranged and routed to allow accessibility to equipment for adjustment and maintenance and to isolate nominal voltage wiring from system low voltage wiring.

**2.08 DEVICE DESCRIPTORS**

- A. Descriptors at SMCCCD MXL panels shall be developed following this standard SMCCCD protocol. No exceptions are allowed.
1. Address, Device, Equipment ID (if needed), Building Number, Floor Number, Description.
  2. Devices shall be identified by an abbreviation or code from the following table below.

<b>Initiating Devices</b>		<b>Communication Devices</b>	
Smoke Detector	SD	Fireman's Phone	FP
Heat Detector	HD	Fireman's Jack	FJ
Duct Detector	DD		
Beam Detector	BD	<b>Panels</b>	
Air Sampling	AS	Fire Alarm Control Panel	FACP
Monitoring Device (By Name)	MSC	Printer	PRT
Pull Station	PS	Annunciator	ANN
Tamper Switch	TS	Video Display Terminal	VDT
Water Flow	WF	Voice Evac Panel	EVAC
Fire Smoke Damper	FSD	Fan Control Panel	FAN
		Network Control Center	NCC
<b>Notification Devices</b>		Aux Power Supply	PWR
Audible	AUD	Dialer	DIAL
Visual	VIS	Foreign System Interface	FSI
Audible/Visual	AV		
Voice Evac Speaker	SPK R		

3. If the device is monitoring or controlling a piece of equipment, then that equipment's ID shall immediately follow the Device. (e.g., TRI HV-5A).
4. If the description is to contain a single compass point, it should be spelled out (e.g., North). If the description uses multiple compass points such as North East it should be abbreviated (e.g., N.E.).
5. If the description contains a room number, then state the building number followed by a dash and then the three digit room number. (e.g., 2-105).
6. Examples:
  - a. 02:002-007 PS B2 F1 RM 2-105.
  - b. 02:001-047 SD B1 F3 MECH RM.
  - c. 02:004-034 DD B7 F3 N.E. CORRIDOR.
  - d. 02:004-059 TRI HV-5A B7 F1 MCC.

**PART 3 - EXECUTION**

**3.01 FIELD QUALITY CONTROL**

- A. Certificate of Compliance: Complete and submit to the project engineer in accordance with NFPA 72, paragraph 1.7.2.
- B. Field Testing, General
1. Each addressable analog smoke detector shall be individually field tested prior to installing the device at its designated location to ensure reliability after shipment and storage conditions. A dated log indicating correct address, type of device, sensitivity and initials of the technician performing the test - using test equipment specifically designed for that purpose - shall be prepared and kept for final acceptance documentation. After testing, the detection devices and base shall be labeled with the system address, date and initials of installing technician. Labeling shall not be visible after installation is complete.



2. Wiring runs shall be tested for continuity, short circuits and grounds before system is energized. Resistance (Megger), current and voltage readings shall be made as work progresses.
    - a. A systematic record shall be maintained of all readings using schedules or charts of tests and measurements. Areas shall be provided on the logging form for readings, dates and witnesses.
    - b. The acceptance inspector shall be notified before the start of any required tests. All items found at variance with the Drawings or this specification during testing or inspection by the acceptance inspector shall be corrected.
    - c. Test reports shall be delivered to the acceptance inspector as completed.
  3. All test equipment, instruments, tools and labor required to conduct the system tests shall be made available by the installing contractor. The following equipment shall be a minimum for conducting the tests:
    - a. Ladders and scaffolds as required to access all installed equipment.
    - b. Multimeter for reading voltage, current and resistance.
    - c. Intelligent device programmer-tester.
    - d. Laptop computer with programming software for any required program revisions.
    - e. Two way radios, flashlights, smoke generation devices and supplies.
    - f. An approved device for measuring air flow through air duct smoke detector sampling assemblies.
    - g. Decibel meter.
    - h. Testing documentation.
  4. In addition to the testing specified to be performed by the installing contractor, the installation shall be subject to test by the acceptance inspector.
- C. Final Acceptance Testing
1. A written "Acceptance Test Procedure" (ATP) for testing the fire alarm system components and installation will be prepared by the Engineer in accordance with NFPA 72 and this specification. The Contractor shall be responsible for the performance of the ATP, demonstrating the function of the system and verifying the correct operation of all system components, circuits and programming.
  2. The acceptance inspector shall use the system record Drawings in combination with the documents specified under sections (2.01-G and 3.01-C.) during the testing procedure to verify operation as programmed. In conducting the ATP, the acceptance inspector shall request demonstration of any or all input and output functions. The items tested shall include but not be limited to the following:
    - a. System wiring shall be tested to demonstrate correct system response and correct subsequent system operation in the event of:
      - 1) Open, shorted and grounded intelligent analog signaling line circuit.
      - 2) Open, shorted and grounded conventional initiating device circuits.
      - 3) Intelligent device removal.
      - 4) Primary power or battery disconnected.
      - 5) Incorrect device address.
    - b. System evacuation alarm indicating appliances shall be demonstrated as follows:
      - 1) All alarm notification appliances actuate as programmed.
      - 2) Audibility and visibility at required levels.
    - c. System indications shall be demonstrated as follows:
      - 1) Correct message display for each alarm input, at the control panel alphanumeric LCD display.
    - d. System on-site and/or off-site reporting functions shall be demonstrated as follows:
      - 1) Correct alarm custom message display, address, device type, date and time transmitted for each alarm input.
      - 2) Correct trouble custom message display, address, device type, date and time transmitted for each alarm input.
      - 3) Trouble signals received for disconnect.

- e. Secondary power capabilities shall be demonstrated as follows:
  - 1) System primary power shall be disconnected for a period of time as specified herein. At the end of that period, an alarm condition shall be created and the system shall perform as specified for a period as specified.
  - 2) System primary power shall be restored for forty-eight hours and system-charging current shall be normal trickle charge for a fully charged battery bank.
  - 3) System battery voltages and charging currents shall be checked at the fire alarm control panel using the test codes and displayed on the LCD display.
- 3. In the event of system failure to perform as specified and programmed during the ATP procedure, at the discretion of the acceptance inspector, the test shall be terminated.
  - a. The installing contractor shall retest the system, correcting all deficiencies and providing test documentation to the acceptance inspector.
  - b. In the event that software changes are required during the ATP, the system manufacturer to compare the edited program with the original shall furnish a utility program. This utility shall yield a printed list of the changes and all system functions, inputs and outputs effected by the changes. The items listed by this program shall be the minimum acceptable to be retested before calling for resumption of the ATP. The printed list and the printer log of the retesting shall be submitted before scheduling of the ATP.
  - c. The acceptance inspector may elect to require the complete ATP to be performed again if, in his opinion, modifications to the system hardware or software warrant complete retesting.

### **3.02 DOCUMENTATION**

- A. System documentation shall be furnished to the owner and shall include but not be limited to the following:
  - 1. System record Drawings and wiring details including 3 sets of as-builts as well as as-builts on a CD-ROM in the current version of AutoCAD.
  - 2. System operation, installation and maintenance manuals.
  - 3. Written documentation for all logic modules as programmed for system operation with a matrix showing interaction of all input signals with output commands.
  - 4. System program "hard copy" showing system functions, controls and labeling of equipment and devices.
  - 5. All specified documentation as required under sections (2.01.E. and 3.01.C.).

### **3.03 CLEANING**

- A. Contractor shall thoroughly clean all areas in which it works at the end of each work day and upon completion of installation.

### **3.04 WARRANTY/SERVICES**

- A. The Contractor shall warrant the entire system against system hardware and electrical defects including programming software defects for a period of one year. This period shall begin upon Substantial Completion of the project by the Architect of Record/Engineer of Record, but not prior to certification of final acceptance testing of the system. Contractor shall provide to owner a letter stating the start-date and end-date of warranty period. In addition, the Contractor shall also provide an updated list of name(s) and phone number(s) for normal and off-hours contacts necessary to respond to warranty issues. Response to warranty notification shall require a reply within 24 hours of initial contact.

**3.05 TRAINING**

- A. The fire alarm contractor shall furnish training as follows for a minimum of four employees of the system user:
  - 1. Training in the receipt, handling and acknowledgment of alarms.
  - 2. Training on system operation including manual control of output functions from the FACP.
  - 3. The total training requirement shall be a minimum of 4 hours, but shall be sufficient to cover all items specified.

**END OF SECTION**

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FIRE ALARM SYSTEM  
for

# Canada College

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## Electrical Infrastructure Replacement Project

4200 Farm Hill Boulevard  
Redwood City, CA 94061

Job Number

4	4	O	P	-	X	X	X	X	X	X
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# FIRE ALARM EQUIPMENT LIST

ITEM NO.	MODEL NO.	DESCRIPTION	DATA SHT NO.	CSFM LISTING NO.
1	FP-11	INTELLIGENT PHOTOELECTRIC SMOKE DETECTOR	6175	7272-0067:0203
2	FPT-11	INTELLIGENT THERMAL FIRE DETECTOR	6176	7272-0067:0202
3	DB-11	BASE FOR INTELLIGENT DETECTORS	6176/6175	7300-0067:0134
4	MSI-10B	INTELLIGENT MANUAL PULL STATION	6187	7150-0067:0036
5	ASWP-2475W-FR	WEATHERPROOF HORN STROBE	---	7125-0785:0131
6	WPBB	WEATHERPROOF BACK BOX	---	---
7	NS-24MCW-FR	MULTI CANDELA HORN/STROBE	---	7125-0785:0142
8	MXL	ADVANCED PROTECTION SYSTEM	---	-----






## FP-11 FirePrint™ Detector

Intelligent Fire Detector for MXL, MXL-IQ, and MXLV Control Panels

### ENGINEER AND ARCHITECT SPECIFICATIONS

- Most Sophisticated "Detector Intelligence" available today
- Multi-Criteria fire detection for the price of a photoelectric detector
- FirePrint™ Technology to discriminate between deceptive phenomena and an actual fire
- Easily programmed to match specific hazard profiles from the control panel
- Pre-Alarm reporting based on fire profile selected
- Remote sensitivity measurement capability
- System logic activation based on any of three inputs from detector (smoke, heat or neural network)
- Field cleanable chamber with replaceable chamber parts available
- Multi-color detector status LED
- Two-wire operation
- Compatible with Model DPU or FPI-32 field programmer/tester
- Supports EnviroLINK software based automatic environmental compensation
- Backward compatible with older MXL systems (Rev. 2 and above)
- Optional fully programmable relay base, audible base, and duct housing
-  UL Listed, ULC Listed, CSFM, FM, NYMEA Approved



### Introduction

The FP-11 Intelligent Fire Detector provides the life safety industry with the most highly evolved detection system available today. The FP-11 utilizes advanced detection technology that allows the detector to distinguish nonthreatening deceptive phenomena, such as cigarette smoke, from actual fire hazards, while optimizing detection for the area in which it is installed. No other detection system available today offers a higher level of protection or nuisance alarm immunity. The FP-11 uses state-of-the-art microprocessor circuitry with error check, detector self-diagnostics and supervision programs.

The FP-11 intelligent fire detector is compatible with the Siemens Building Technologies, Fire Safety Division, Model DPU or FPI-32 field programmer/tester, which is a compact, portable, menu-driven accessory for electronically programming and testing detectors, easily and reliably. The DPU or FPI-32 eliminates the

need for cumbersome, unreliable mechanical programming methods and reduces installation and service costs by electronically programming and testing the detector prior to installation.

The FP-11 fire detector is compatible with the MXL family of control panels including the MXL, MXL-IQ, and MXLV.

The FP-11 detector is Underwriters Laboratories and Underwriters Laboratories of Canada Listed.

### Description

The FP-11 is a plug-in, two-wire, multi-sensor detector with both photoelectric and thermal inputs and is compatible with the MXL family of control panel systems. Each detector consists of a dust resistant, field cleanable photo chamber, a solid state

non-mechanical thermal sensor, microprocessor based electronics with a low-profile plastic cover and base. The FP-11 utilizes state-of-the-art ASIC and surface mount technology for maximum reliability. Every FP-11 fire detector is shipped with a protective dust cover.

The FP-11 fire detector utilizes an infrared light emitting diode (IRLED), and light sensing photodiode. Under normal conditions, light transmitted by the LED is directed away from the photodiode and scattered through the smoke chamber in a controlled pattern. The smoke chamber is designed to manage light dissipation and extraneous reflections from dust particles or other non-smoke airborne contaminants in such a way as to maintain stable, consistent detector operation. When smoke enters the detector chamber, light emitted from the IRLED is scattered by the smoke particles and is received by the photodiode.

The FP-11 also utilizes a modern, accurate, shock-resistant thermistor to sense temperature changes. The "on-board" FirePrint technology allows the detector to gather smoke and thermal data, and to analyze this information in the detector's "neural network." By comparing data received with the common characteristics of fires, or fire fingerprints, the FP-11 can compare these "Fire Prints" to those of deceptive phenomena that cause other detectors to alarm. The advanced FirePrint technology allows the FP-11 to accurately determine a true fire hazard from a nonthreatening deceptive phenomena WITHOUT needing to use alarm delaying verification and confirmation techniques, which can increase the probability of losses due to fire.

The FP-11 provides the highest level of detector intelligence available today with a detector/control panel link that allows the user to program the detector for the specific hazard profile. Detectors are optimized by selecting one of the following applications:

- Office/Retail
- Lobby
- Computer Room
- Dormitory
- Healthcare
- Parking Garage
- Utility/Transformer Room
- Hostile Environment
- Precious Storage
- Air Duct
- Warehouse/Light Manufacturing

The software does the rest; no guessing on detector sensitivities or alarm verification; the control panel programs the FP-11 detector for the protected area without hassle and without confirmation delays. Once optimized for the hazards in the protected area, the FP-11 provides the best detection you can buy. Should the operator or installer forget to program the detector, the FP-11 will revert to a default setting that allows it to operate as a standard photoelectric or photothermal detector.

The FP-11's FirePrint technology monitors input from both the photo chamber and the thermal sensor,

evaluating this information with sophisticated mathematical formulas, or algorithms, comparing this input to characteristics of both threatening fires and deceptive phenomena that would "fool" any ordinary detector. This technology was developed over years of research and reviewing the results of over 20 years of fire test data in one of the world's most advanced fire research centers. The results of this research are the mathematical models that form the algorithms used in FirePrint. No other fire detector has this level of intelligence or this amount of research and development supporting its design.

The microprocessor's software can identify and disregard false input caused by radio frequency (RFI) and electromagnetic (EMI) interference, and validates all trouble conditions before annunciating or reporting to the control panel. The FP-11 detector's microprocessor uses an integral EEPROM to store the detector's address and other critical operating parameters which include the assigned program values for alarm and trouble thresholds. Communications within the detector itself and between the FP-11 and the control panel, or with the FPI-32 field programmer/tester, are supervised and safeguarded against disruption by reliable, microprocessor based error checking routines. Additionally, the microprocessor supervises all EEPROM memory locations and provides a high degree of EEPROM failure fault tolerance.

In MXL(V) applications, the FP-11 determines its operating status to be normal, in alarm, or in trouble depending on the difference between the alarm threshold values stored in the detector's memory and the detector's latest analog measurement. The detector then communicates changes in its status to the control panel.

In addition, the MXL(V) control panel will sample the value of the FP-11's analog signal over a period of time in order to determine if those values indicate excessive buildup in the photo chamber; if so, the MXL(V) will indicate that the particular detector requires maintenance.

The FP-11 is listed as a self-testing device. The FP-11's visible light emitting diode (LED) flashes green every 4 seconds to indicate it is communicating with the control panel and that it has passed its internal self-test. Should the detector sense a fault or failure within its systems, the LED will flash amber and the detector will transmit that information to the control panel. A quick visual inspection is sufficient to indicate the condition of the detector at any time. If more detailed information is required, a printed report can be provided from the MXL panel indicating the status and settings assigned to each individual detector.

When the FP-11 moves to the alarm mode, it will flash amber and transmit that information to the control panel. When the MXL(V) confirms the detectors condition, the panel will instruct the FP-11 to flash red and to continue flashing until the system is reset at the control panel. At that same time, any user defined

system alarm functions programmed into the system are activated. Each FP-11 detector can operate one remote alarm indicator, one auxiliary relay, or one audible base.

Detector sensitivity, calibration, and identification are dynamically supervised by the control panel. Detector sensitivity and pre-alarm levels are a function of the application chosen at the control panel and are controlled by the panel. If an alternate, non-FirePrint mode is selected, then the sensitivity can be changed from the control panel.

The DPU or FPI-32 Program/Test accessory is used to program and verify the detector's address. The technician selects the accessory's program mode to enter the desired address. The DPU or FPI-32 automatically sets and verifies the address and tests the detector. It also allows the user to change the device ID from that of an FP-11 to an older detector ID such as an ILP-1, ILPT-1, ILP-2, ID-60P or ID-60PT to allow for easy replacement of older detectors without the need of reprogramming the control panel.

The FPI-32 operates on AC power or rechargeable batteries, providing flexibility and convenience in programming and testing equipment almost anywhere. When in the test mode, the DPU or FPI-32 will perform a series of diagnostic tests without altering the address or other stored data, allowing technicians to determine if the detector is operating properly.

The FP-11 fire detector may be installed on the same initiating circuit with IL or ID series detectors (Photoelectric, thermal, or ionization), MSI series manual stations, TRI series interfaces, ICP output control devices, or CZM series of addressable, conventional zone modules.

All FP-11 detectors can be cleaned in the field, when required, by simply removing the detector cover and unsnapping the photo chamber. There is also the option of cleaning the interior of the detector with a clean, soft cloth or brush, or replacing the labyrinth and bug screen included in the detector maintenance kit, model DMK-11.

The FP-11 uses the low profile surface mounting base, model DB-11. This base mounts on a 4-inch octagon, square, or a single gang electrical box. The base utilizes screw clamp contacts for electrical connections and self-wiping contacts for increased reliability. The base can be used with the optional LK-11 detector locking kit which contains 50 detector locks and an installation tool, to prevent unauthorized removal of the detector head. The DB-11 base has integral decorative plugs to cover the outer mounting screw holes.

The FP-11 is electrically compatible with existing MXL detector accessories including relays, remote lamps, duct housings, and audible bases. With duct housings, a base adapter and new detector housing cover are required (order AD-11UK upgrade kit). To use existing DB-3S base or audible base, the FP-11 requires a DB-ADPT base adapter.

All FP-11 detectors are approved for operation within the UL specified temperature range of 32 to 100 degrees F (0 to 38 degrees C).

## Application Data

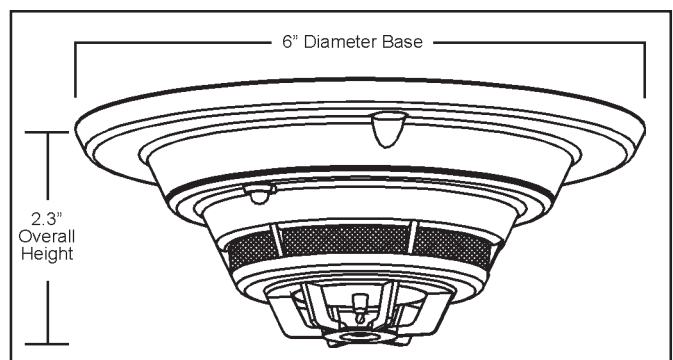
Installation of the FP-11 series of fire detectors requires a two-wire circuit of 18 AWG (minimum) thermoplastic fixture wire enclosed in conduit, or 18 AWG limited energy, shielded cable without conduit, if permitted by local codes. Field wiring should conform to local and National Electric Codes and the control panel wiring specifications.

"T-tapping" is permitted only for Style 4 (Class B) wiring.

FP-11 fire detectors can be applied within the maximum 30 foot center spacing (900 sq. ft. areas) as referenced in NFPA 72. This applications guideline is based on ideal conditions, specifically, smooth ceiling surfaces, minimal air movement, and no physical obstructions between potential fire sources and the detector. Do not mount detectors in close proximity to ventilation or heating and air conditioning outlets. Exposed joints or beamed ceilings may also affect safe spacing limitations for detectors. Should questions arise regarding detector placement, observe NFPA 72 guidelines.

Good fire protection system engineering and common sense dictate how and when fire detectors are installed and used. Contact your local Siemens Building Technologies, Fire Safety Division authorized sales outlet whenever you need assistance applying FirePrint in unusual applications. Be sure to follow NFPA guidelines, UL/ULC approved installation instructions, which are included with every detector, and local codes as for all fire protection equipment.

## Dimensions



## Technical Specifications

Current Requirements: Normal 750  $\mu$ A Alarm 750  $\mu$ A

Operating Temperature: +32°F (0°C) to 100°F (38°C)  
per UL 268/268A

Humidity: 0-93% Relative Humidity  
Non-Condensing


## Ordering Information

Model	Description	Part Number
FP-11	Addressable FirePrint Fire Detector	500-095112
DB-11	Detector Mounting Base for Series 11	500-094151
DB-11E	Detector Base (Small)	500-094151E
AD2-P	Air Duct Housing for use with FP-11, HFP-11, HFPO-11, PE-11	500-649706
AD2-XHR	Air Duct Housing for use with FP-11, HFP-11, HFPO-11 with relay	500-649708
ADBX-11	Audible Base	500-096181
DB-X11RS	Relay Base for Series 11 Intelligent Detectors	500-096125
RLI-1	Remote (red) alarm indicator- 4" octagon box mount	500-390673
RLI-2	Remote (red) alarm indicator- single gang box mount	500-390674
LK-11	Base Locking Kit for Series 11 detectors	500-695350
DMK-11	Series 11 Maint Kit (replacement labyrinth and bug bug screen)	500-695338
DB-ADPT	Base Adapter to DB-3S Base	500-094187
<b>In Canada Order:</b>		
FP-11C	Addressable FirePrint Fire Detector (ULC)	500-095112C
DB-11C	Detector Mounting Base for Series 11 (ULC)	500-095687
AD-11PC	Air Duct Housing (ULC)	500-095984
DB-X11RSC	Relay Base for Series 11 Intelligent Detectors (ULC)	500-096125C
ADBX-11C	Audible Base for Series 11 Intelligent Detector (ULC)	500-096181C

# MXL, MXL-IQ and MXLV Control Panels

## Intelligent Thermal Detector Model FPT-11

### ARCHITECT AND ENGINEER SPECIFICATIONS

- Microprocessor-based design
- Rate compensated
- Innovative technology provides high-speed, fault-tolerant System / Detector communications
- Multi-color detector status LED
- Optional fully-programmable relay and audible bases
- Two-wire operation
- Backward compatible with older MXL systems (Rev 2 and Above)
- Compatible with DPU or FPI-32 field programmer / tester
-  UL and  ULC Listed; FM, CSFM & NYMEA Approved



### Product Overview

The FPT-11 Intelligent Thermal Detector, which operates with the MXL family of control panels: MXL, MXL-IQ and MXLV, provides an advanced method of detection / address programming and supervision – combined with sophisticated control-panel communication. The FPT-11 detector uses a state-of-the-art thermistor that provides up to 135°F (57.2°C) rate-compensated temperature.

The FPT-11 Intelligent Thermal Detector is compatible with the DPU and FPI-32 Field Programmer / Testers. These testers are compact, portable and menu-driven accessories that make programming and testing detectors faster, easier and more reliable than other methods. The FPI-32 Field Programmer / Testers eliminate the need for cumbersome, unreliable mechanical programming methods, and reduce installation and service costs, via electronically programming addresses and functionally testing

the FPT-11's performance before the detector is installed.

The FPT-11 Intelligent Thermal Detector is Underwriters' Laboratory listed and Underwriters' Laboratory of Canada listed.

### Specifications

The FPT-11 is a plug-in, two-wire thermal detector, compatible with the MXL family of control panels. Each FPT-11 has microcomputer-chip technology and highly stable, solid-state electronic circuitry. The FPT-11 utilizes a modern, accurate and shock-resistant thermistor to sense temperature changes. This electronic sensing method virtually eliminates thermal lag associated with mechanical-temperature sensing devices, and provides almost instantaneous temperature information to the control panel.

## Specifications – (continued)

The FPT-11 is a 135°F (57.2°C) rate-compensated detector. The microprocessor for the FPT-11 detector uses an integral EEPROM to store the detector's address. Communications within the detector, as well as between the FPT-11 and the control panel (or with the FPI-32 field programmer / tester) are supervised and safeguarded against disruption by reliable microprocessor-based error-checking routines. Additionally, the microprocessor supervises all EEPROM memory locations, and provides a high degree of EEPROM failure fault tolerance.

The FPT-11 is listed as a self-testing device. The visible Light-Emitting Diode (LED) from the FPT-11 flashes green every four seconds to indicate it is communicating with the control panel and to notify it has passed its internal self-test. Should the detector sense a fault or failure within its systems, the LED will flash amber, and the detector will transmit that information to the control panel. A quick, visual inspection is sufficient to indicate the condition of the detector at any time. If more detailed information is required, a printed report can be provided from the MXL panel indicating the status and settings assigned to each individual detector.

When the FPT-11 moves to the 'Alarm' mode, the FPT-11 will flash amber and transmit that data to the control panel. When the MXL (V) confirms the current condition of the FPT-11, the panel will instruct the FPT-11 detector to flash 'red' until the system is reset at the control panel. At that same time, any user-defined, system-alarm functions programmed into the MXL System are activated. Each FPT-11 detector can operate (1) remote alarm indicator, (1) auxiliary relay, or (1) audible base, and only (1) accessory per detector.

A DPU or FPI-32 programmer / tester is used to program and verify the address for the FPT-11. The user selects the 'Program' mode to enter the desired address. The programmer / tester then automatically sets and verifies the address as well as test the detector. The programmer / tester contains rechargeable batteries, in order for the address of the FPT-11 to be programmed by the user from the most convenient location. The user can also separately test the FPT-11 detector for functionality. When the user selects the 'Test' Mode, a series of tests are automatically conducted, and the user is informed whether the FPT-11 detector has passed or failed.

The FPT-11 detector is compatible on the same MXL- initiating circuit with other IL Series, FP Series or ID-60 Series addressable ionization, photoelectric, or thermal detectors, MSI addressable manual stations, TRI Series addressable interfaces, or CZM Series addressable conventional zone modules.

Each FPT-11 thermal detector is capable of operating one "X" or "I" Series remote alarm indicator or auxiliary relay or audible base. The FPT-11 detectors use a surface mounting base, Model DB-11, which mounts on a 4-inch octagonal, square or single gang electrical box. Relay base Model DB-X11 RS mounts to a 4-inch square deep electrical box. Audible base Model ADBX-11 also mounts to a 4-inch square deep electrical box.

The DB-11, and the DB-X11 RS and ADBX-11 use screw-clamp terminals for all electrical connections and self-wiping contacts for reliability. The bases also contain a provision for an optional concealed locking mechanism to prevent unauthorized removal of the detector head, Model LK-11.

## Application Data

The MXL uses ALD loop circuits with each circuit capable of supporting up to (60) FPT-11 intelligent detectors.

The detector, or group of detectors, require a two-wire circuit of minimum 18 AWG thermoplastic fixture wire enclosed in conduit, or minimum 18 AWG limited energy, shielded cable without conduit if permitted by local building codes. Wiring should conform to local and National Electrical Codes, and to the control panel's wiring specifications. T-tapping is permitted only for Style 4 (Class B) wiring.

Locate the FPT-11 on the ceiling, at least 4 inches from the side walls. For an ideal, smooth ceiling condition, place the detectors at a maximum center spacing of 50 feet (2,500 square feet), 25 feet from side walls or room partitions. For FM-approved installations, the FPT-11 has a RTI rating of 'QUICK.' Use a maximum center spacing of 20 feet (400 square feet), 10 feet from side walls or room partitions.

Actual job conditions and sound engineering judgment must determine detector spacing. Consider environmental factors including ambient temperature fluctuation, and the nature of the fire hazard. Room or area configuration and ceiling type (sloped or flat, smooth or beamed) also dictates placement.

Should questions arise regarding detector placement, follow the drawings provided and / or approved by Siemens Building Technologies – Fire Safety Division or by its authorized distributors.

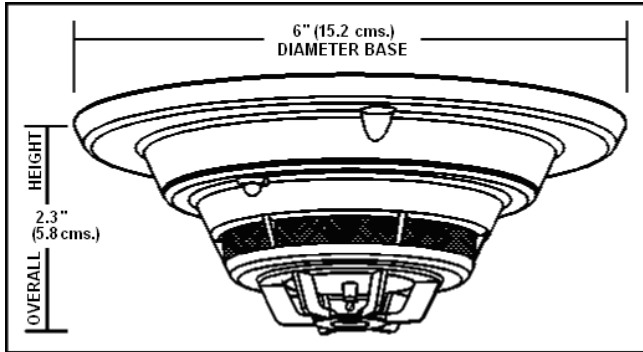
## Technical Data

**Current Requirements:** Normal 750  $\mu$ a  
Alarm 750  $\mu$ a

**Operating Temperatures:** +32°F (0°C) to  
100° F (38°C)

**Humidity:** 0-93% Relative Humidity  
Non-condensing

## Mounting Diagram



## Details for Ordering

Model No.	Part No.	Description
FPT-11	500-095918	Addressable Thermal Fire Detector
DB-11	500-094151	Detector Mounting Base for Series 11
DB-11E	500-094151E	Small 4.5 inch Diameter Detector Base
DB-X11RS	500-096125	Relay Base for Series 11 Intelligent Detectors
ADBX-11	500-096181	Audible Base for Series 11 Intelligent Detector
RLI-1	500-390673	Remote (red) alarm indicator-octagon box mount
RLI-2	500-695350	Remote (red) alarm indicator-single gang box mount
LK-11	500-695350	Base Locking Kit for Series 11
DB-ADPT	500-094187	Base Adapter to DB-3S Base

### In Canada Order:

Model No.	Part No.	Description
FPT-11C	500-095918C	Addressable Thermal Fire Detector (ULC)
DB-11C	500-095687	Detector Mounting Base for Series 11(ULC)
DB-X11RSC	500-096125C	Relay Base for Series 11 Intelligent Detectors (ULC)
ADBX-11C	500-096181C	Audible Base for Series 11 Intelligent Detector (ULC)

**Notice:** This marketing catalog sheet is not intended to be used for system design or installation purposes. For the most up-to-date information, refer to each product's installation instructions.






## Intelligent Initiating Devices

### Manual Fire Alarm Boxes

### MSI-10B and MSI-20B Intelligent Manual Fire Alarm Boxes for MXL, IXL, and XL3 Control Panels

#### ENGINEER AND ARCHITECT SPECIFICATIONS

- Durable Design
- Shock and Vibration Resistant
- Pull Down Lever Remains Down Until Reset
- Custom Microcomputer Chip Technology
- Dynamic Supervision
- Reset with Allen Key
- No Break Rods Necessary
- Two Wire Operation
- Surface or Semiflush Installation
- DPU or FPI-32 Programs and Verifies Device's Address and Tests Device's Functionality
- Electronic Address Programming is Easier and More Dependable
- Single and Double Action Models Available
-  Listed, CSFM, FM and NYMEA Approved



### Introduction

Siemens Building Technologies, Fire Safety MSI-10B and 20B intelligent manual fire alarm boxes provide the markets' most advanced method of address programming and supervision, combined with sophisticated control panel communication. Each MSI manual fire alarm box incorporates a new custom microcomputer chip. The microcomputer chip technology, and its sophisticated bi-directional communication capabilities with the control panel, achieves the state of an "Intelligent Initiating Device."

### Description

The MSI-10B and 20B are constructed of durable molded polycarbonate material which is matte finished in red with raised white lettering. The housing accommodates a "pull-down" lever which, when operated, locks in position indicating the manual fire alarm box has been activated. The pull down lever remains down and locked until the manual fire alarm box is reset. The manual fire alarm box is reset only by opening the hinged housing cover with an allen key and then closing and locking the cover.

The MSI-10B and 20B manual fire alarm boxes operate with the MXL, IXL/ICON-1 and XL3 control panels.

The manual fire alarm box's microcomputer chip has the capacity of storing, in memory, identification information as well as important operating status information.

Fire Safety's innovative technology also allows all MSI Series Intelligent manual fire alarm boxes to be programmed by using the Model DPU or FPI-32 Programmer/Tester. The Programmer/Tester is a compact, portable, menu driven accessory which makes programming and testing a manual fire alarm box device faster, easier and more dependable than previous methods. The DPU or FPI-32 eliminates the need for the device's mechanical addressing mechanisms, such as program jumpers, dipswitches or rotary dials because the Programmer/Tester electronically sets the manual fire alarm box's address into its microcomputer chip, nonvolatile memory. Vibration, corrosion and

other conditions which deteriorate mechanical addressing mechanisms are no longer a cause for concern.

The MSI-10B and 20B are fitted with screw terminals for connection to an addressable circuit. They can be either surface or semiflush mounted.

The MSI Series manual fire alarm boxes derive their power, communicate information and receive commands over a single pair of wires.

The MSI Series is compatible on the same circuit with all IL and ID-60 Series ionization, photoelectric or thermal detectors, TRI Series interfaces or CZM Series addressable conventional zone modules.

The MSI-10B and 20B intelligent manual fire alarm boxes are Underwriters Laboratories, Inc. listed.

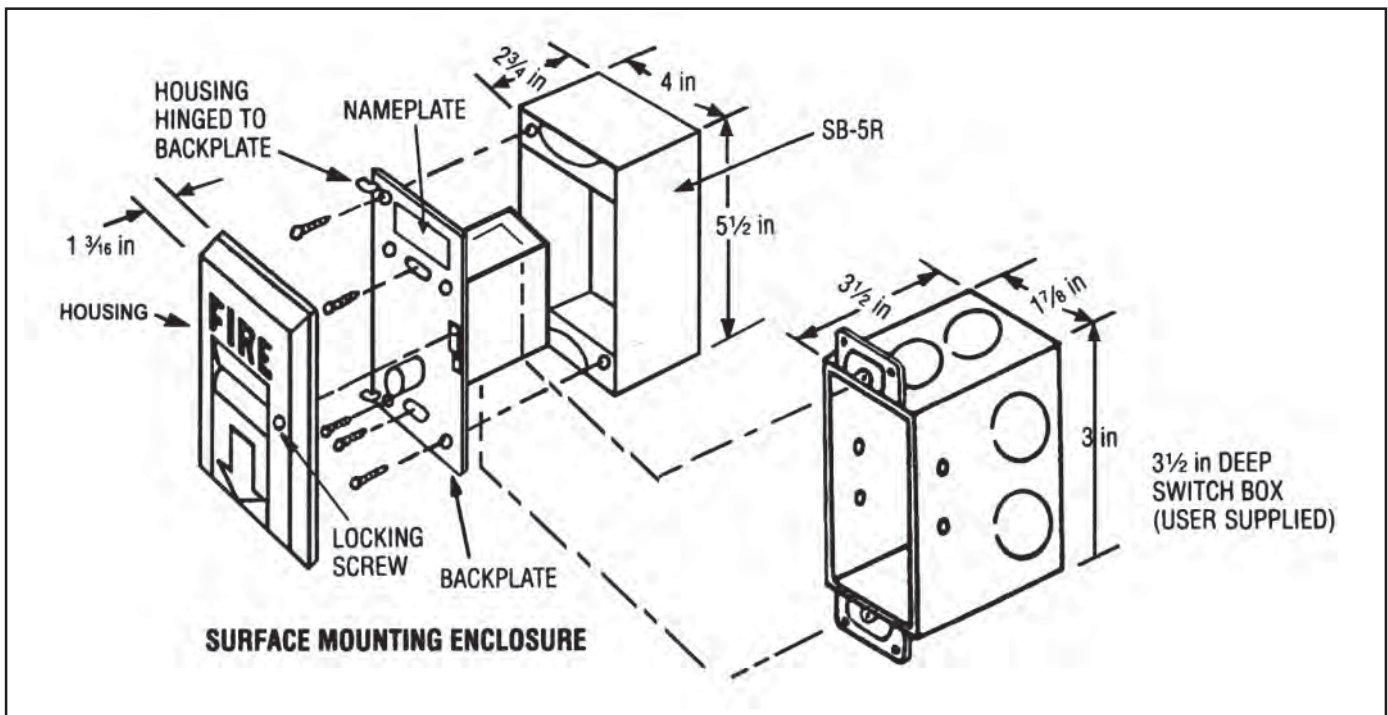
## Ordering Information

Model	Description	Shipping Wt.	
		Lb.	Kg.
MSI-10B	Addressable Manual Fire Alarm Box, Single Action	2	.90
MSI-20B	Addressable Manual Fire Alarm Box, Double Action	2.5	1.13
SB-5R	Surface Mounting Box	1.5	.68
LTP	Reset Tool Package (Contains 2 Tools)	.5	.23

## Current Draw

1mA

## Mounting Data



## Series AS Audible Strobe Appliances and Series AH Audibles



**SERIES AS**



**SERIES AH**

### Description

The Wheelock patented 2-wire Series AS Audible Strobe Appliances and Series AH Audibles offer more features with low current draw.

Strobe options for wall mount models include 1575cd or the Wheelock patented MCW multi-candela wall strobes with field selectable candela settings of 15/30/75/110cd, or the high intensity MCWH strobe with field selectable 135/185cd.

Ceiling mount models incorporate Wheelock's patented MCC multi-candela ceiling strobe with field selectable intensities of 15/30/75/95cd or the high intensity MCCH strobe with field selectable 115/177cd.

The audible provides a selectable choice of either a continuous horn or temporal pattern (Code 3) when constant voltage from a Fire Alarm Panel (FACP) is applied. Each tone has 3 dBA settings to choose from.

When used with the Wheelock Series SM,DSM Sync Modules, Wheelock Power Supplies or other manufacturers panels incorporating the Wheelock Patented Sync Protocol, synchronization of the continuous horn tone provides the temporal (code 3) tone (mandated by NFPA 72) simultaneously for all audible appliances. This ensures a distinct temporal (code 3) pattern when 2 or more audibles are within hearing distance. If not synchronized the temporal sound could overlap and not be distinctive. At the same time the strobes will be synchronized. This provides the ability to comply with ADA guidelines concerning photosensitive epilepsy and the NFPA standards when installing 2 or more visual appliances within the field of view all of this plus the ability to silence the audible is achieved by using only 2 wire.

### Features

- Approvals include: UL Standard 1971, UL Standard 464 New York City (MEA), California State Fire Marshal (CSFM), Factory Mutual (FM), and Chicago (BFP). See approvals by model in Specifications and Ordering Information
- ADA/NFPA/UFC/ANSI Compliant
- Wall mount models are available with Field Selectable Candela Settings of 15/30/75/110cd or 135/185cd (Multi-Candela models) or 1575cd (single candela model)
- Ceiling mount models are available with field selectable candela settings of 15/30/75/95cd or 115/177cd (multi-candela ceiling models)
- Selectable Continuous Horn or Temporal (Code 3).
- 3 Selectable dBA settings (99, 95 and 90 dBA) in both tones
- Patented 2-Wire Audible Strobe Appliance.
- Patented Universal Mounting Plate
- Weatherproof models are available for outdoor use
- Strobes produce 1 flash per second over the regulated voltage range
- 12 and 24 VDC models with wide UL "Regulated Voltage Range" using filtered DC or unfiltered FWR input voltage
- Synchronize using the Wheelock Sync Modules or panels with built-in Wheelock Patented Sync Protocol
- Fast installation with IN/OUT screw terminals using #12 to #18 AWG wires

*For Weatherproof Series AS, See Datasheet S9004*



E5946  
S5391



151-92-E



7125-0785:131



NOTE: All CAUTIONS and WARNINGS are identified by the symbol **▲**. All warnings are printed in bold capital letters.

**▲ WARNING:** PLEASE READ THESE SPECIFICATIONS AND ASSOCIATED INSTALLATION INSTRUCTIONS CAREFULLY BEFORE USING, SPECIFYING OR APPLYING THIS PRODUCT. VISIT [WWW.COOPERWHEELLOCK.COM](http://WWW.COOPERWHEELLOCK.COM) OR CONTACT COOPER WHEELLOCK FOR THE CURRENT INSTALLATION INSTRUCTIONS. FAILURE TO COMPLY WITH ANY OF THESE INSTRUCTIONS, CAUTIONS OR WARNINGS COULD RESULT IN IMPROPER APPLICATION, INSTALLATION AND/OR OPERATION OF THESE PRODUCTS IN AN EMERGENCY SITUATION, WHICH COULD RESULT IN PROPERTY DAMAGE, AND SERIOUS INJURY OR DEATH TO YOU AND/OR OTHERS.

**General Notes:**

- Strobes are designed to flash at 1 flash per second minimum over their “Regulated Voltage Range”. Note that NFPA-72 specifies a flash rate of 1 to 2 flashes per second and ADA Guidelines specify a flash rate of 1 to 3 flashes per second.
- All candela ratings represent minimum effective Strobe intensity based on UL Standard 1971.
- Series NS Strobe products are listed under UL Standard 1971 for indoor use with a temperature range of 32°F to 120°F (0°C to 49°C) and maximum humidity of 93% (± 2%).
- Series NH horns are listed under UL Standard 464 for audible signal appliances (Indoor use only).
- **“Regulated Voltage Range” is the newest terminology used by UL to identify the voltage range. Prior to this change UL used the terminology “Listed Voltage Range”.**

Model Number	Input Voltage VDC	Regulated Voltage Range VDC/FWR	Strobe Candela (cd)
AS-24MCW	24	16.0 - 33.0	15/30/75/110
AS-24MCCH	24	16.0 - 33.0	115/177
AS-241575W	24	16.0 - 33.0	15 (75 on Axis)
AS-121575W	12	8.0 – 17.5	15 (75 on Axis)
AS-24MCC	24	16.0 - 33.0	15/30/75/95
AS-24MCWH	24	16.0 - 33.0	135/185
ASWP-2475W	24	16.0 - 33.0	75 @ -31°F

Description	Volume	Reverberant dBA Per UL 464 @ 10 ft.	Anechoic dBA @ 10 ft.
Continuous Horn	High	91	99
	Medium	88	95
	Low	83	90
Code 3 Horn	High	87	99
	Medium	84	95
	Low	79	90

24 VDC Models		Audible	Wall Mount Audible Strobe Models							Ceiling Mount Audible Strobe Models					
		AH-24	AS-241575W	AS-24MCW				AS-24MCWH		AS-24MCC				AS-24MCCH	
			1575cd	15cd	30cd	75cd	110cd	135cd	185cd	15cd	30cd	75cd	95cd	115cd	177cd
High (99) dBA	24 vdc	<b>0.062</b>	<b>0.100</b>	<b>0.080</b>	<b>0.102</b>	<b>0.150</b>	<b>0.194</b>	<b>0.250</b>	<b>0.320</b>	<b>0.088</b>	<b>0.114</b>	<b>0.165</b>	<b>0.205</b>	<b>0.250</b>	<b>0.320</b>
	UL max*	0.080	0.121	0.088	0.125	0.200	0.267	0.355	0.480	0.095	0.138	0.221	0.285	0.355	0.480
Med (95) dBA	24 vdc	<b>0.033</b>	<b>0.080</b>	<b>0.060</b>	<b>0.084</b>	<b>0.132</b>	<b>0.173</b>	<b>0.230</b>	<b>0.305</b>	<b>0.066</b>	<b>0.092</b>	<b>0.145</b>	<b>0.186</b>	<b>0.230</b>	<b>0.305</b>
	UL max*	0.043	0.107	0.074	0.110	0.190	0.253	0.340	0.465	0.080	0.122	0.201	0.269	0.340	0.465
Low (90) dBA	24 vdc	<b>0.017</b>	<b>0.072</b>	<b>0.052</b>	<b>0.076</b>	<b>0.121</b>	<b>0.158</b>	<b>0.220</b>	<b>0.295</b>	<b>0.056</b>	<b>0.082</b>	<b>0.132</b>	<b>0.173</b>	<b>0.220</b>	<b>0.295</b>
	UL max*	0.021	0.100	0.068	0.105	0.182	0.245	0.335	0.460	0.074	0.113	0.198	0.263	0.335	0.460

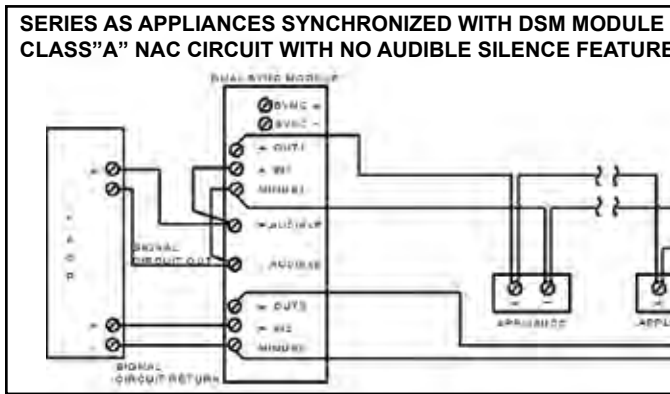
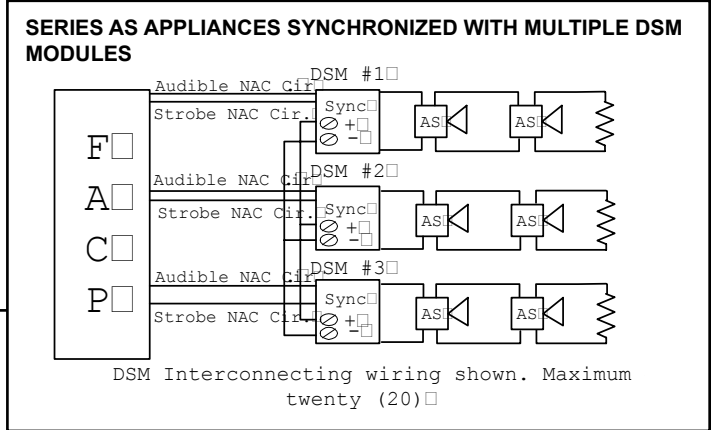
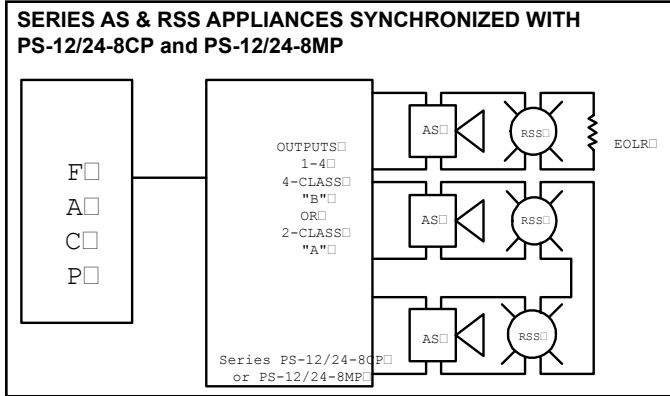
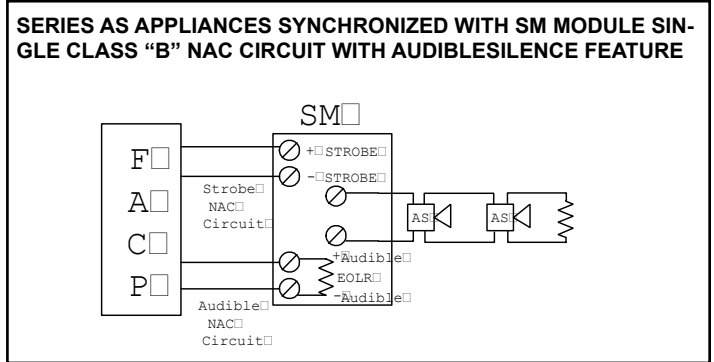
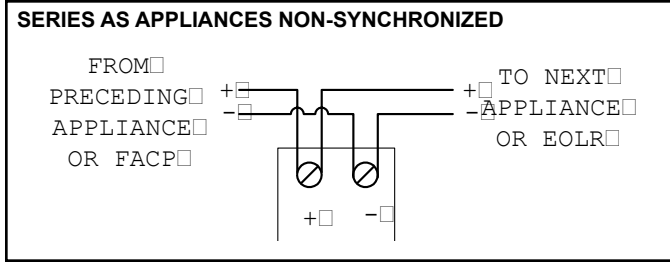
12 VDC Models		Audible	Wall Mount Audible Strobe
		AH-12	AS-121575W
High (99) dBA	12 vdc	0.163	0.260
	UL max*	0.192	0.320
Med (95) dBA	12 vdc	0.076	0.195
	UL max*	0.108	0.275
Low (90) dBA	12 vdc	0.039	0.175
	UL max*	0.058	0.265

Voltage	High dBA Setting (99) dBA	Medium dBA Setting (95) dBA	Low dBA Setting (90) dBA
24.0 VDC	0.128	0.105	0.098
UL Max*	0.168	0.155	0.150

\* RMS current ratings are per UL average RMS method. UL max current rating is the maximum RMS current within the listed voltage range (16-33v for 24v units). For strobes the UL max current is usually at the minimum listed voltage (16v for 24v units). For audibles the max current is usually at the maximum listed voltage (33v for 24v units). For unfiltered FWR ratings, see installation instructions.

## Wiring Diagrams#



# For detail using SM or DSM Sync Module refer to Data Sheet S3000 or Installation Instructions P83123 for SM and P83177 for DSM. For wiring information on the power supplies refer to Installation Instructions P84662 for PS-24-8MC.

## Specifications and Ordering Information

Model Number	Order Code	Strobe Candela	Non-Sync	Sync w/SM, DSM or PS-24-8MC	24 VDC	12 VDC	Wall Mount	Ceiling Mount	Mounting Options***	Agency Approvals				
										UL	MEA	CSFM	FM	BFP
AS-24MCW-FR	9024	15/30/75/110	X	X	X	-	X	-	A,B,D,E,F,G,H,J,N,O,R,X	X	X	X	X	X
AS-24MCW-FW	9025	15/30/75/110	X	X	X	-	X	-	A,B,D,E,F,G,H,J,N,O,R,X	X	X	X	X	X
AS-24MCWH-FR	3468	135/185	X	X	X	-	X	-	A,B,D,E,F,G,H,J,N,O,R,X	X	X	X	X	*
AS-24MCWH-FW	3469	135/185	X	X	X	-	X	-	A,B,D,E,F,G,H,J,N,O,R,X	X	X	X	X	*
AS-241575W-FR	7405	15 (75 on Axis)	X	X	X	-	X	-	A,B,D,E,F,G,H,J,N,O,R,X	X	X	X	X	X
AS-121575W-FR	7410	15 (75 on Axis)	X	X	-	X	X	-	A,B,D,E,F,G,H,J,N,O,R,X	X	X	X	X	X
AS-24MCC-FR	3161	15/30/75/95	X	X	X	-	-	X	A,B,D,E,F,G,H,J,N,O,R,X	X	X	X	X	*
AS-24MCC-FW	3162	15/30/75/95	X	X	X	-	-	X	A,B,D,E,F,G,H,J,N,O,R,X	X	X	X	X	*
AS-24MCCH-FW	3467	115/177	X	X	X	-	-	X	A,B,D,E,F,G,H,J,N,O,R,X	X	X	X	X	*
ASWP-2475W-FR**	9012	75 @ -31°F	X	X	X	-	X	-	I (see Data Sheet S9004)	X	X	X	X	X
AH-24-R	7892	-	X	X	X	-	X	X	A,B,D,E,F,G,H,J,N,O,R,X	X	X	X	X	X
AH-24-W	7893	-	X	X	X	-	X	X	A,B,D,E,F,G,H,J,N,O,R,X	X	X	X	X	X
AH-12-R	7891	-	X	X	-	X	X	X	A,B,D,E,F,G,H,J,N,O,R,X	X	X	X	X	X
AH-12-W	7894	-	X	X	-	X	X	X	A,B,D,E,F,G,H,J,N,O,R,X	X	X	X	X	X
AH-24WP-R**	7416	-	X	X	X	-	X	X	K	X	X	X		X
AH-12WP-R**	7415	-	X	X	-	X	X	X	K	X	X	X		X

\*\*For Weatherproof Series AS/AH specifications see data sheet S9004.

\*\*\*Refer to Data Sheet S7000 for Mounting Options.

Note: Models are available in either Red or White. Contact Customer Service for Order Code and Delivery.

\*PENDING

**NOTE: Due to continuous development of our products, specifications and offerings are subject to change without notice in accordance with Wheelock Inc. standard terms and conditions.**

## Architects and Engineers Specifications

The notification appliances shall be Wheelock Series AS Audible Strobe appliances and Series AH Audible appliances or approved equals. The Series AS Audible be listed for UL Standard 1971 (Emergency Devices for the Hearing-Impaired) for Indoor Fire Protection Service. The Series AH Audible shall be UL Listed under Standard 464 (Fire Protective Signaling). Both shall meet the requirements of FCC Part 15 Class B. All inputs shall be compatible with standard reverse polarity supervision of circuit wiring by a Fire Alarm Control Panel (FACP).

The audible portion of the appliance shall have a minimum of three (3) field selectable settings for dBA levels and shall have a choice of continuous or temporal (Code 3) audible outputs.

The strobe portion of the appliance shall produce a flash rate of one (1) flash per second over the Regulated Voltage Range and shall incorporate a Xenon flashtube enclosed in a rugged Lexan® lens. The Series AS shall be of low current design. Where Multi-Candela appliances are specified, the strobe intensity shall have field selectable settings and shall be rated per UL Standard 1971 at 15/30/75/110 or 135/185 candela for wall mount and 15/30/75/95 or 115/177 candela for ceiling mount. The selector switch for selecting the candela shall be tamper resistant. The 1575 candela strobe shall be specified when 15 candela UL Standard 1971 Listing with 75 candela on-axis is required (e.g. ADA compliance).

When synchronization is required, the appliance shall be compatible with Wheelock's SM, DSM Sync Modules, Wheelock Power Supplies or other manufacturers panels with built-in Wheelock Patented Sync Protocol. The strobes shall not drift out of synchronization at any time during operation. If the sync module or Power Supply fails to operate, (i.e., contacts remain closed), the strobe shall revert to a non-synchronized flash-rate. The appliance shall also be designed so that the audible signal may be silenced while maintaining strobe activation when used with Wheelock synchronization.

The Series AS Audible Strobe and Series AH Audible shall incorporate a Patented Universal Mounting Plate that shall allow mounting to a single-gang, double-gang, 4-inch square, 100mm European type backboxes, or the SHBB Surface Backbox. If required, an NATP (Notification Appliance Trimplate) shall be provided.

All notification appliances shall be backward compatible.



WE ENCOURAGE AND SUPPORT NICET CERTIFICATION  
3 YEAR WARRANTY  
Made in USA

**S8100 AS/AH 10/07**

#### NJ Location

273 Branchport Ave.  
Long Branch, NJ 07740  
P: 800-631-2148  
F: 732-222-8707

[www.coopernotification.com](http://www.coopernotification.com)

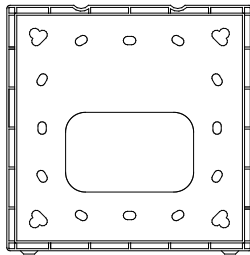
#### FL Location

7565 Commerce Ct.  
Sarasota, FL 34243  
P: 941-487-2300  
F: 941-487-2389

#### VA Location

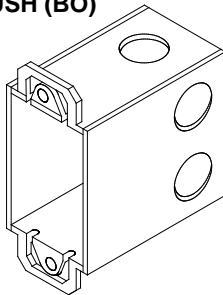
2009 North 14th St., Ste. 510  
Arlington, VA 22201  
P: 877-459-7726  
F: 703-294-6560

### (A) UNIVERSAL MOUNTING PLATE



"AS" Mounting

### (B) SINGLE-GANG, FLUSH (BO)



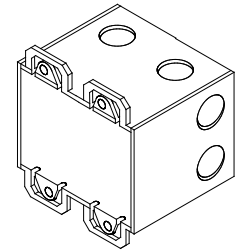
See Notes 1 & 8

MAXIMUM NUMBER OF CONDUCTORS

AWG. #18	AWG. #16	AWG. #14	AWG. #12
4	4	4	4

Used with Series AH, AS, MIZ, NH, NS, RSS

### (F) DOUBLE-GANG, FLUSH (BO)



See Notes 4

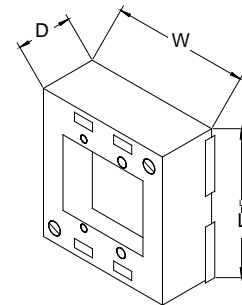
MAXIMUM NUMBER OF CONDUCTORS

AWG. #18	AWG. #16	AWG. #14	AWG. #12
4	4	4	4

Used with Series AMT, AH, AS, HS4, HS, MT, NH, NS, RSS

### (G) DOUBLE-GANG, SURFACE (BO)

L.	W.
4-3/4"	4-3/4"
D.	GANG #
1-3/4"	2



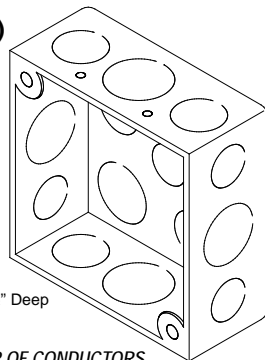
See Note 5

MAXIMUM NUMBER OF CONDUCTORS

AWG. #18	AWG. #16	AWG. #14	AWG. #12
4	4	4	4

Used with Series AH, AS, NH, NS, RSS

### (D) 4" SQUARE, FLUSH (BO)



1-1/2" Deep

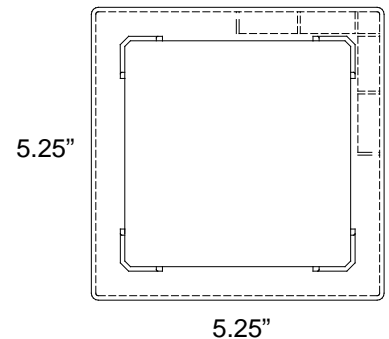
See Note 2

MAXIMUM NUMBER OF CONDUCTORS

AWG. #18	AWG. #16	AWG. #14	AWG. #12
4	4	4	4

Used with Series 31T, 43T, AMT, AH, AS, HS4, HS, MB, MT, MT4, NH, NS, RSS

### (H) NATP (Order Codes: Red 8440, White 8441)



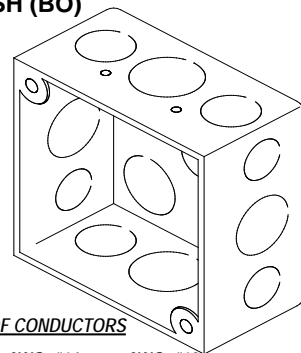
5.25"

5.25"

Thickness: 13/64"

Used with Series AH, AS, NH, NS, RSS

### (E) 4" SQUARE, DEEP, FLUSH (BO)



2-1/8" Deep

See Note 3

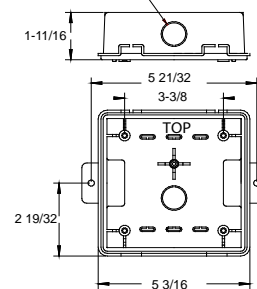
MAXIMUM NUMBER OF CONDUCTORS

AWG. #18	AWG. #16	AWG. #14	AWG. #12
8	8	8	8

Used with Series 31T, 43T, AMT, AH, AS, ET-1010, HS4, HS, MB, MT, MT4, NH, NS, RSS, RSSP

### (I) WPBB (Order Code: 9014)

For surface mounting AS outdoor products.



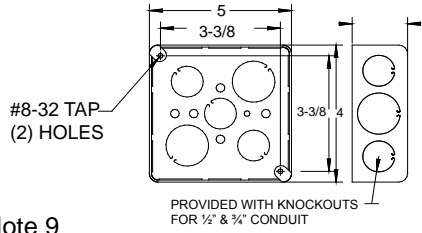
MAXIMUM NUMBER OF CONDUCTORS

AWG. #18	AWG. #16	AWG. #14	AWG. #12
8	8	8	8

Used with Series ASWP Weatherproof

**(J) BB BACKBOX (Order Codes: Red 2830, Gray 2349)**

Standard steel backbox with knockouts for interior surface mounting, concealed conduit mounting or semi-flush applications. It is painted to match the signal.



See Note 9

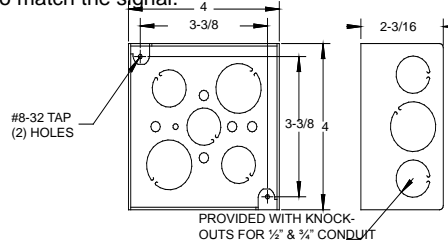
**MAXIMUM NUMBER OF CONDUCTORS**

AWG. #18	AWG. #16	AWG. #14	AWG. #12
4	4	4	4

Used with Series 31T, 43T, AH, AS, MB, MT4, NH, NS, RSS

**(N) DBB BACKBOX (Order Code: 2955)**

Standard steel backbox provided with knockouts for interior surface mounting, concealed conduit mounting or semi-flush applications. It is painted to match the signal.



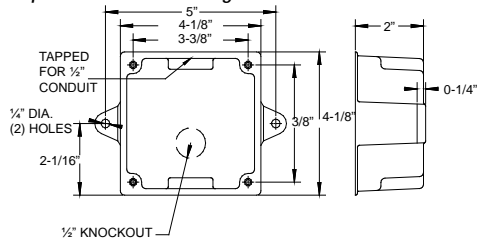
**MAXIMUM NUMBER OF CONDUCTORS**

AWG. #18	AWG. #16	AWG. #14	AWG. #12
8	8	8	8

Used with Series 31T, 43T, AMT, AH, AS, ET-1010, HS4, HS, MB, MT, MT4, NH, NS, RSS

**(K) WBB WEATHER RESISTANT BACKBOX (Order Codes: Red 2959, White 2411)**

Sturdy die cast housing, threaded conduit hole and knockout for outdoor applications. It is painted to match the signal.

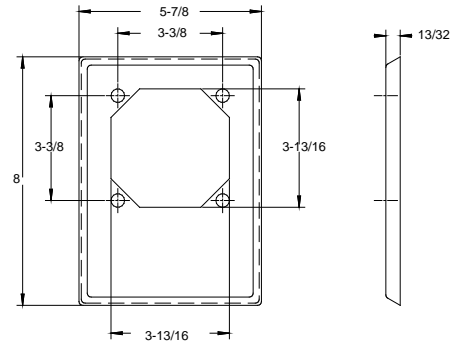


**MAXIMUM NUMBER OF CONDUCTORS**

AWG. #18	AWG. #16	AWG. #14	AWG. #12
4	4	4	4

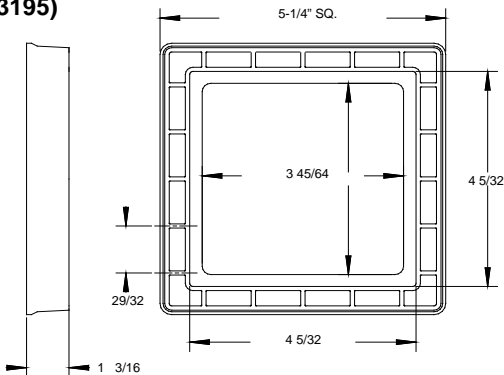
Used with Series 31T, 43T, AHWP, ET-1010, MB, MT4

**(O) RP-R RETROFIT PLATE (Order Code: 5042)**



Used with Series 31T, 43T, AMT, AH, AS, CH70, E70, ET70, ET-1010, ET-1080, HS4, HS, MB, MT, MT4, NH, NS, RSS

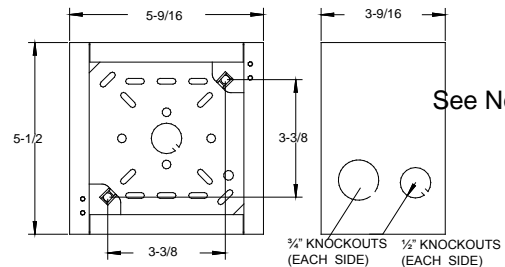
**(L) ISP2 SURFACE ADAPTER (Order Code: Red 3194, White 3195)**



Used with Series AMT, CH70, E70, ET70, HS4, HS, MT

**(P) SBB BACKBOX (Order Codes: Red 3204, White 3193)**

For surface mounting speakers, chimes, and electronic applications.



See Note 11

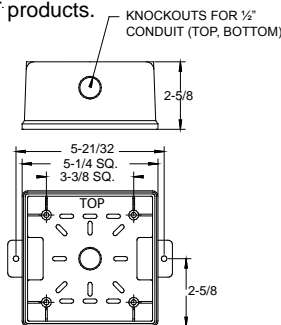
**MAXIMUM NUMBER OF CONDUCTORS**

AWG. #18	AWG. #16	AWG. #14	AWG. #12
8	8	8	8

Used with Series 43T, AMT, CH70, E70, ET70, ET-1080, HS4, HS, MB, MT, NH, NS, RSS

**(M) IOB BACKBOX (Order Codes: Red 5046, White 5047)**

For surface mounting MT products.



See Note 10

**MAXIMUM NUMBER OF CONDUCTORS**

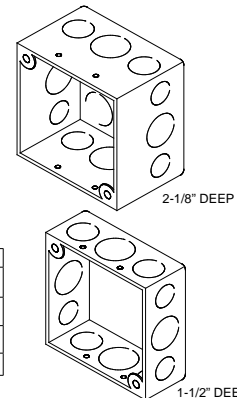
AWG. #18	AWG. #16	AWG. #14	AWG. #12
8	8	8	8

Used with Series AMT, ET70WP, HS4, HS, MT, MTWP

**(Q) 4" SQUARE DEEP W/ EXTENSION RING, FLUSH (BO)**

See Note 6

EXT. RING DEPTH	1-1/2"	2-1/8"
AWG. #18	8	8
AWG. #16	8	8
AWG. #14	8	8
AWG. #12	4	8

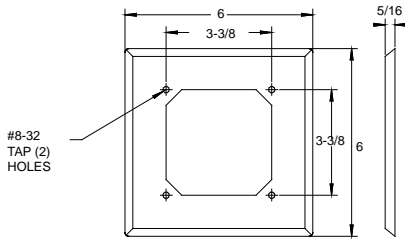


Used with Series CH70, CH90, E70, ET70, E90, ET90, ET-1080



**(R) SFP SEMI-FLUSH PLATE (Order Codes: Red 2957, White 2958)**

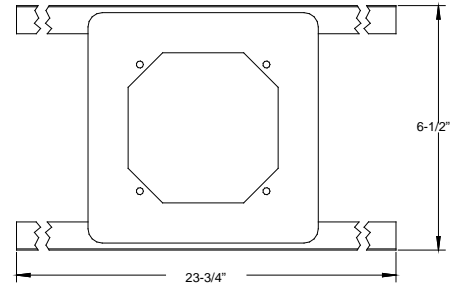
Stamped aluminum surface wall plate which mounts behind the basic unit and serves to cover recessed backboxes in semi-flush mounting applications. It is painted to match the signal.



Used with Series 31T, 43T, AMT, AH, AS, CH70, E70, ET70, ET-1010, ET-1080, HS4, HS, MB, MT, MT4, NH, NS, RSS

**(V) SSB-4 CEILING SUPPORT BRIDGE (Order Code: 3380)**

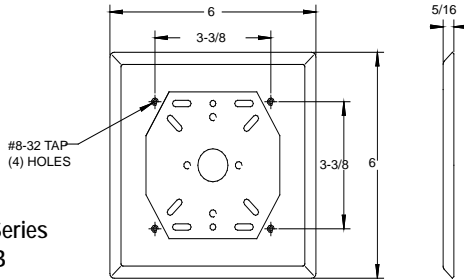
Provisions for (4) J-nuts #8-32 ib 3-3/8" square Material: Steel



Used with Series CH70, CH90, E70, ET70, E90, ET90, ET-1080

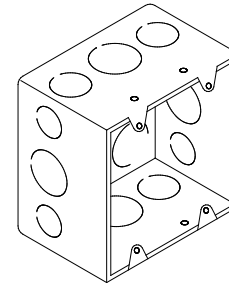
**(S) AP ADAPTER PLATE (Order Code: 2961)**

Stamped aluminum adapter plate designed for applications where semi-flush installations cannot be used. The plate can be mounted to standard octagon or round backboxes single or double gang boxes or plaster rings. The backbox and basic unit are then fastened to the plate. This type mounting is referred to as a concealed conduit installation. It is painted to match the signal.



Used with Series 43T, MB

**(W) 4 11/16" SQUARE, DEEP SURFACE (B0)**



See Note 7

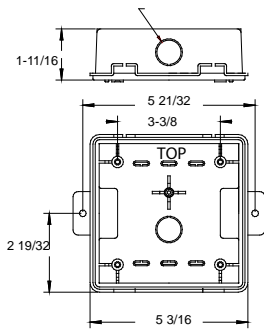
**MAXIMUM NUMBER OF CONDUCTORS**

AWG. #18	AWG. #16	AWG. #14	AWG. #12
10	10	10	10

Used with Series SM, DSM

**(T) WPSBB-R (Order Codes: Red 9751, White 3033)**

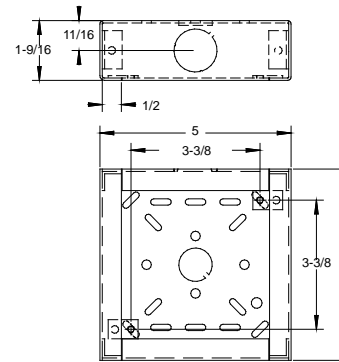
Used with Series RSSWP Weather-proof



**MAXIMUM NUMBER OF CONDUCTORS**

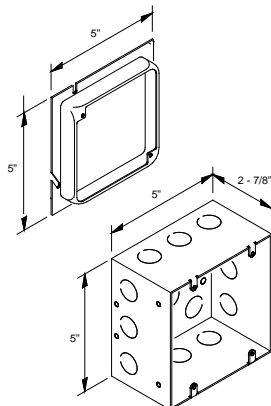
AWG. #18	AWG. #16	AWG. #14	AWG. #12
8	8	8	8

**(X) SHBB SQUARE, SURFACE BACKBOX (Order Codes: Red 7254, White 7255)**



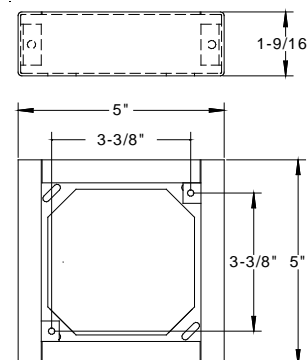
Used with Series 43T, AH, AS, MB, NH, NS, RSS

**(U) 5" SQUARE BACKBOX W/ EXTENSION RING, FLUSH (B0)**



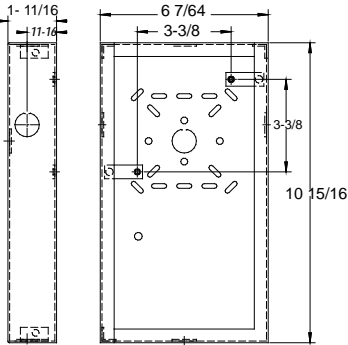
Used with Series CH70, CH90, E70, ET70, E90, ET90, ET-1080

**(Y) SER-R SQUARE SEMI-FLUSH EXTENSION RING (Order Codes: Red 3045, White 3049)**



Used with Series CH70 E70, ET70

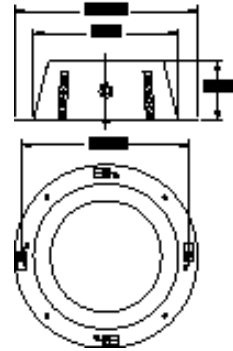
**(Z) SBL-2 BACKBOX (Order Codes: Red 6988, White 6989)**



See Note 12

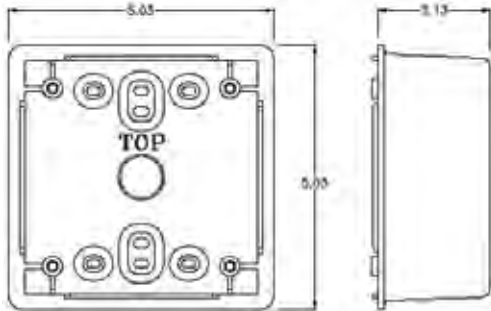
Used with Series RSSP

**(DD) CBB-8 8" CEILING SPEAKER BACKBOX (Order Code: 3314)**



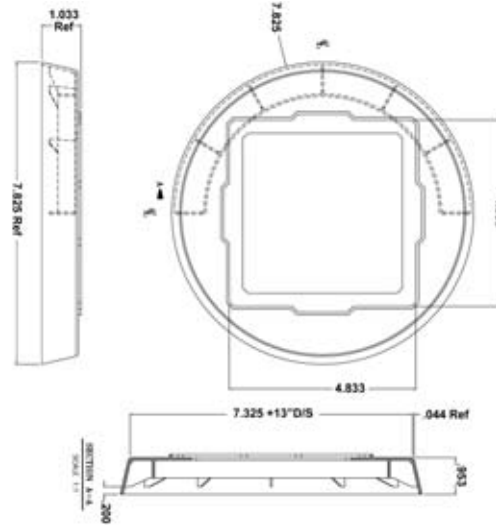
Used with Series S 8" Ceiling Speakers

**(AA) E50SB-R (Order Codes: Red 0230, White 0231)**

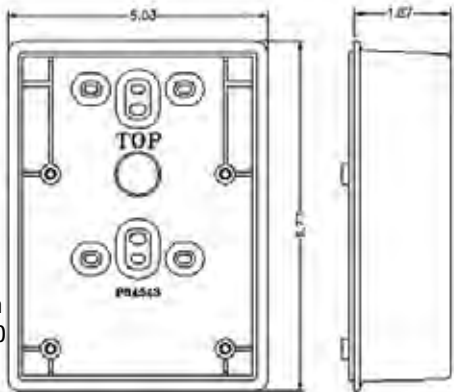


Used with Series E50

**(EE) E60 EXTENSION RING (Order Code: Red 3578, White 3757)**

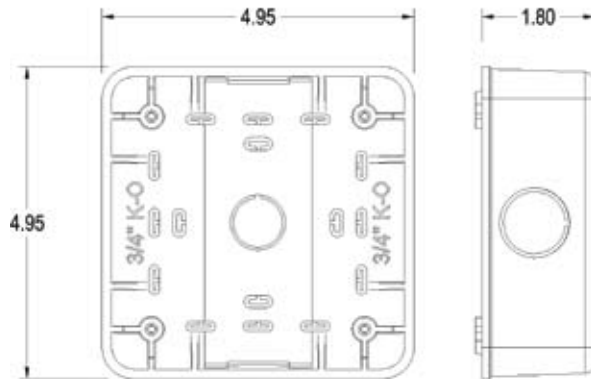


**(BB) E50SSB-R (Order Codes: Red 0232, White 0233)**

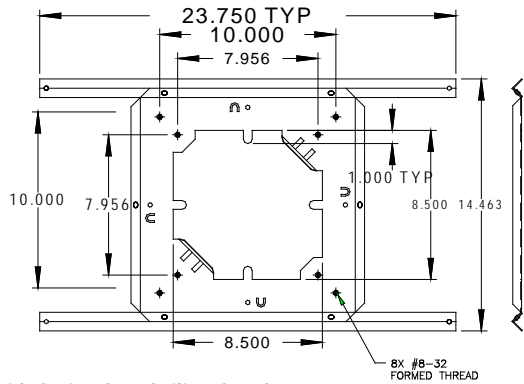


Used with Series E50

**(FF) ZBB (Order Codes: Red 6036, White 6045)**



**(CC) SSB-8 8" CEILING SUPPORT BRIDGE (Order Code: 3573)**



Used with Series S 8" Ceiling Speakers



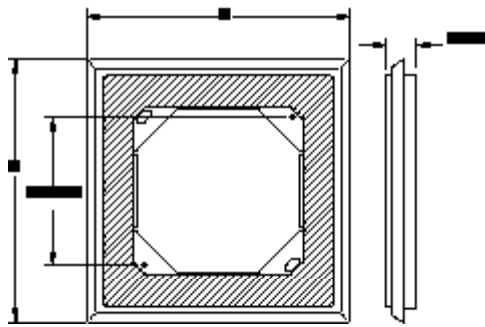
S5391  
S2652



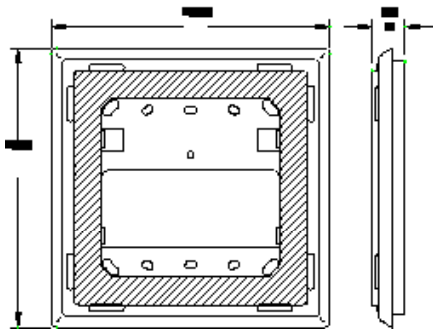
151-92-E



**(GG) WFP PLATE (Order Codes: Red 4696, White 4697)**



**(HH) WFPA PLATE (Order Codes: Red 4696, White 4697)**



**BACKBOX DIMENSIONS FOR MPS**

**4-3/4" H x 3-1/4" W x 2-1/4" D**

**GENERAL NOTES**

1. FIGURE B IS TYPICAL OF A STEEL CITY LXM-WOW BOX OR EQUAL. FIGURE B SHOULD BE A 3.5" DEEP BACKBOX FOR CONDUIT INSTALLATIONS AND IS TYPICAL OF A STEEL CITY CY-1/2 BOX OR EQUAL.
2. FIGURE D IS TYPICAL OF A STEEL CITY 52151 BOX OR EQUAL.
3. FIGURE E IS TYPICAL OF A STEEL CITY 52171 BOX OR EQUAL.
4. FIGURE F IS TYPICAL OF TWO STEEL CITY LXM-WOW BOXES OR EQUAL.
5. FIGURE G IS TYPICAL OF A WIREMOLD 5748-2 BOX OR EQUAL.
6. FIGURE Q IS TYPICAL OF A STEEL CITY 52171 BOX WITH A STEEL CITY 53151 EXTENSION RING OR EQUAL.
7. FIGURE W IS TYPICAL OF A STEEL CITY 72171-1 BOX OR EQUAL.
8. USE 3.5 DEEP BACKBOX ON ALL MIZ PRODUCTS WHEN EMT CONDUIT IS USED.
9. WHEN USED WITH AC HORN (J), "BB" MUST BE USED FOR SURFACE MOUNT.
10. HS4, HS, MT OR MTWP STROBE ARE FOR OUTDOOR MOUNTING.
11. USE WITH SERIES RSSP.
12. FIGURE U IS TYPICAL OF A RANDL INDUSTRIES BACKBOX. ("Total Number of conductors shall be in accordance with NEC table 314.16 (B)").

# MOUNTING MATRIX

	Series E90/ET90	Series RSS/RSSR	Series RSSP	Series 31T	Series E50	Series 43T Bells	Series CH	Series ET80	Series ET1010	Series MB Motor Bells	Series E70/ET70	Series E60	Series MIZ/MIZ-TC	Series MT	Series NH/NS	Series HS4/HS	Series SM/DSM	Series AMT	Series AS/AH	Series RSSWP(1), ASWP(2), AHWP(3), MTWP(4), MT-12-24(4), ET70WP(4)	Series S	Series Z
(A) Universal Mounting Plate																			X			
(B) 1-GANG x 2" Deep - Flush (BO) Note 1 & 8		X											X		X				X			X
(D) 4" x 4" x 1.5" Deep - Flush (BO) Note 2		X	X	X		X				X									X			X
(E) 4" x 4" x 2.125 Deep - Flush (BO) Note 3		X	X	X	X	X		X		X				X	X	X		X	X			X
(F) 2-Gang x 3.5" Deep - Flush (BO) Note 4 & 8		X												X	X	X		X	X			X
(G) 2-Gang x 1.75" Deep - Surface (BO) Note 5		X													X				X			
(H) NATP Trim Plate		X													X				X			
(I) WPBB-R Weatherproof Backbox for ASWP																					2	
(J) BB Surface (WSI) Note 9		X		X	X				X	X					X				X			
(K) WBB Weatherproof (WSI)				X	X			X	X										X		3	
(L) ISP Adapter (WSI) for Square Products							X	X						X		X			X			
(M) IOB Surface & Weatherproof (WSI) Note 10										X				X		X			X		4	
(N) DBB Surface (WSI)		X		X	X			X	X					X	X	X			X	X		
(O) RP-R Retrofit Plate		X		X	X	X	X		X					X	X	X			X	X		
(P) SBB Surface (WSI) Note 11	X	X				X	X	X		X	X			X	X	X			X			
(Q) 4" x 4" x 2.125" Box w/ 1.5" Extension Ring- Flush (BO) Note 6	X		X				X	X			X	X										
(R) SPT Semi-Flush Plate (WSI)		X		X	X	X	X		X	X				X	X	X			X	X		
(S) AP Adapter Plate (WSI)						X			X	X	X											
(T) WPSBB-R Weatherproof Backbox for RSSWP																					1	
(U) 5" Square Backbox w/ Extension Ring, Flush (BO)	X						X	X			X											
(V) SSB-4 Ceiling (WSI) Support Bridge	X						X	X			X	X							X			
(W) 4.6875" x 4.6785" x 2.125" Deep Surface (BO)																	X					
(X) SHBB (WSI) Shallow Surface		X				X				X					X				X			
(Y) SER Semi-Flush Extension Ring (Retrofit Appl.)	X						X				X											
(Z) SBL-2 Surface (WSI) Note 11		X	X	X		X	X	X		X												
(AA) E50SB Backbox for E50 Speaker					X																	
(BB) E50SB Backbox for E50 Speaker Strobe					X																	
(CC) SSB-8 8" Speaker Support Tile Bridge																						X
(DD) CBB-8 8" Ceiling Speaker Backbox																						X
(EE) E60 Extension Ring											X											
(FF) ZBB																						X
<b>Data Sheet Number(s)</b>	S0310 S1610	S0410 S9008	S0410	S0500	S0510	S0600	S0710	S0800	S0800	S1500	S0310 S1610	S1611	S1700	S2000	S2100	S2400	S3000	S4000	S8100	S9004 S9006	S1100	Z1000

## MOUNTING NOTES

▲ **Caution:** The mounting options figures show the maximum number of field wires (conductors) that can enter the backbox used with each mounting option. If these limits are exceeded, there may be insufficient space in the backbox to accommodate the field wires and stresses from the wires could damage the product.

Although the limits shown for each mounting option comply with the National Electrical code (NEC), Wheelock recommends use of the largest backbox option and the use of approved stranded field wires whenever possible, to provide additional wiring room for easy installation and minimum stress on the product from wiring.

▲ **Caution:** Check that the installed product will have sufficient clearance and wiring room prior to installing backboxes and conduit, especially if sheathed multiconductor cable or 3/4" conduit fittings are used.

1. Mounting hardware for each mounting option is supplied.

2. Conduit entrances to the backbox should be selected to provide sufficient wiring clearance for the installed product. When extension rings are required, conduit should enter through the backbox, not the extension ring. Use Steel City #53151 (1-1/2" deep) or #53171 (2-1/8" deep) extension rings (as noted in the mounting options) or equal with the same cut-out area.

3. When terminating field wires, do not use more lead length than required. Excess lead length could result in insufficient wiring space for the appliance.

4. Use care and proper techniques to position the field wires in the backbox so that they use minimum space and produce minimum stress on the product. This is especially important for stiff, heavy gauge wires and wires with thick insulation or sheathing.

5. Do not pass additional wires (used for other than the appliance) through the backbox "unless the backbox is of a sufficient size to permit additional wiring as described in NEC 314.16 (B)". Such additional wires could result in insufficient wiring space for the appliance.

NOTE: Due to continuous development of our products, specifications and offerings are subject to change without notice in accordance with Wheelock Inc. standard terms and conditions.

## BACKBOX MOUNTING HEIGHTS for WHEELLOCK WALL MOUNTED HORIZONTAL STROBE APPLIANCES

**NFPA-72 (2002)**

**7.5.4\* Appliance Location.** Wall-mounted appliances shall be mounted such that the entire lens is not less than 2.0 m (80 in.) and not greater than 2.4 m (96 in) above the finished floor.

Backbox Mounting Options*	Series AS/AH Audible Strobe		Series RSSP Flush and Surface Retrofit Plate		Series NS Horn Strobe		Series Z and RSS Strobe		Series MT and AMT Multitone Strobe	
	80 IN	6 IN	80 IN	6 IN	80 IN	6 IN	80 IN	6 IN	80 IN	6 IN
(B) 1-Gang x 2" Deep - Flush (BO)	77 ½"	8 ½"			78 ¾"	7 ⅝"	79 ⅛"	6 ⅞"		
(D) 4" x 4" x 1.5" Deep - Flush (BO)	77"	9"	83 15/16"		77 7/8"	8 1/8"	78 5/8"	7 3/8"	79 15/16"	6 1/16"
(E) 4" x 4" x 2.125" Deep - Flush (BO)	77"	9"	83 15/16"		77 7/8"	8 1/8"	78 5/8"	7 3/8"	79 15/16"	6 1/16"
(F) 2-Gang x 3.5" Deep - Flush (BO)	77 ½"	8 ½"			78 ¾"	7 ⅝"	79 ⅛"	6 ⅞"	80 9/16"	5 7/16"
(G) 2-Gang x 1.75" Deep - Surface (BO)	77 ½"	8 ½"			78 ¾"	7 ⅝"	79 ⅛"	6 ⅞"	80 9/16"	5 7/16"
(M) IOB Surface & Weatherproof (WSI)									79 3/8"	6 5/8"
(P) SBB Surface (WSI)									79 ¼"	6 3/4"
(Q) 4" x 4" x 2.125" Box w/ 1.5" Extension Ring - Flush (BO)										
(U) 5" Square Backbox w/ Extension Ring, Flush (BO)	69 ½"	8 ½"	83 7/16"		77 3/8"	7 5/8"	78 1/8"	6 7/8"	79 7/16"	5 9/16"
(X) SHBB (WSI) Shallow Surface	76 ½"	9 ½"			77 3/8"	8 5/8"	78 1/8"	7 7/8"		
(Y) 4" x 4" x 1.5" Box w/ 1.5" Extension Ring Plate (BO)										
(Z) SBL-2 Surface (WSI)			78"							
(FF) ZBB							78 1/8"	7 7/8"		

Backbox Mounting Options*	Series CH70 Chime Strobe		Series ET80 Speaker Strobe		Series E70 Speaker Strobe		Series ET70 Speaker Strobe		Series SA-70S Self Amplified Speaker Strobe	
	80 IN	6 IN	80 IN	6 IN	80 IN	6 IN	80 IN	6 IN	80 IN	6 IN
(P) SBB Surface (WSI)	77 ¾"	8 ¼"	79 3/16"	6 13/16"	77 ¾"	8 ¼"	77 ¾"	8 ¼"	79 3/16"	6 13/16"
(Q) 4" x 4" x 2.125" Box w/ 1.5" Extension Ring - Flush (BO)	77 ½"	7 ½"	80	6"	78 ½"	7 ½"	78 ½"	7 ½"	80"	6"
(U) 5" Square Backbox w/ Extension Ring - Flush (BO)	78"	7"	79 ½"	5 ½"	78"	7"	78"	7"	79 ½"	5 ½"
(X) SHBB (WSI) Shallow Surface										
(Y) 4" x 4" x 1.5" Box w/ 1.5" Extension Ring Plate - Flush (BO)	78 ½"	7 ½"	80"	6"						

\* Measured from Bottom of Backbox

**NOTES:**

**(BO) = By Others**

**(WSI) = Wheelock Product**



WE ENCOURAGE AND SUPPORT NICET CERTIFICATION  
3 YEAR WARRANTY

S7000 Mounting 02/07

**NJ Location**

273 Branchport Ave.  
Long Branch, NJ 07740  
P: 800-631-2148  
F: 732-222-8707

[www.coopernotification.com](http://www.coopernotification.com)

**FL Location**

7565 Commerce Ct.  
Sarasota, FL 34243  
P: 941-487-2300  
F: 941-487-2389

**VA Location**

P: 877-459-7726  
F: 703-294-6560

Cooper Notification is Wheelock®



**COOPER**Notification

## Series NS Horn Strobes and Series NH Horns



**Series NS**



**Series NH**

### **Description:**

The Series NS Horn Strobe Appliances are designed for indoor, wall and ceiling mount applications.

The Series NH Horn and the horn portion of the Series NS include a selectable continuous horn tone or temporal pattern (Code 3) with selectable dBA settings of 90 or 95 dBA.

Strobe options include 1575cd or the Wheelock patented Multi-Candela strobe with field selectable candela settings of 15/30/75/110cd for wall mount and 15/30/75/95cd and 115/177cd for ceiling mount.

These versatile Horn Strobe Appliances can be synchronized using the Wheelock SM, DSM Sync Modules, Wheelock Power Supplies or other manufacturers panels incorporating the Wheelock Patented Sync Protocol. Additionally, the audible may be silenced while maintaining strobe activation.

All models of the Series NS and NH are designed for maximum performance, reliability and cost-effectiveness while meeting or exceeding the latest requirements of NFPA 72/ANSI 117.1/UFC and UL Standards 1971 and 464 as well as meeting ADA requirements concerning photosensitive epilepsy.

The Wheelock patented 2-Wire Series NS Horn Strobes and Series NH Horns offer more features with lower current draw than competitors.

### **Features:**

- Approvals include: UL Standard 1971, UL Standard 464, New York City (MEA), California State Fire Marshal (CSFM), Factory Mutual (FM) and Chicago (BFP). See approvals by model number in Specifications and Ordering Information
- ADA/NFPA/UFC/ANSI compliant
- Complies with OSHA 29, Part 1910.165
- Wall mount model Field Selectable Candela Setting 15/30/75/110cd (24 VDC Multi-Candela models) or 1575cd in 12 or 24 VDC
- Ceiling mount model Field Selectable Candela Setting 15/30/75/95cd and 115/177cd (24 VDC Multi-Candela models)
- Selectable Continuous Horn or Temporal (Code 3)
- 2 Selectable dBA settings of 90 and 95 dBA in both tones
- Patented Universal Mounting Plate
- 12 and 24 VDC models with UL "Regulated Voltage" using filtered DC or unfiltered VRMS input voltage
- Wall and Ceiling Mount
- Ceiling models with same look as Wheelock round ceiling strobes and speakers
- NH horn is selectable 12 or 24 VDC in 1 appliance
- Synchronize using Wheelock Sync Modules or panels with built-in Wheelock Patented Sync Protocol
- Fast installation with IN/OUT screw terminals using #12 to #18 AWG wires



E5946  
S5391



151-92-E



7125-0785:142



**NOTE: All CAUTIONS and WARNINGS are identified by the symbol ▲. All warnings are printed in bold capital letters.**

**▲ WARNING: PLEASE READ THESE SPECIFICATIONS AND ASSOCIATED INSTALLATION INSTRUCTIONS CAREFULLY BEFORE USING, SPECIFYING OR APPLYING THIS PRODUCT. VISIT WWW.COOPERWHEELLOCK.COM OR CONTACT COOPER WHEELLOCK FOR THE CURRENT INSTALLATION INSTRUCTIONS. FAILURE TO COMPLY WITH ANY OF THESE INSTRUCTIONS, CAUTIONS OR WARNINGS COULD RESULT IN IMPROPER APPLICATION, INSTALLATION AND/OR OPERATION OF THESE PRODUCTS IN AN EMERGENCY SITUATION, WHICH COULD RESULT IN PROPERTY DAMAGE, AND SERIOUS INJURY OR DEATH TO YOU AND/OR OTHERS.**

## General Notes:

- Strobes are designed to flash at 1 flash per second minimum over their “Regulated Voltage Range”. Note that NFPA-72 specifies a flash rate of 1 to 2 flashes per second and ADA Guidelines specify a flash rate of 1 to 3 flashes per second.
- All candela ratings represent minimum effective Strobe intensity based on UL Standard 1971.
- Series NS Strobe products are listed under UL Standard 1971 for indoor use with a temperature range of 32°F to 120°F (0°C to 49°C) and maximum humidity of 93% (± 2%).
- Series NH horns are listed under UL Standard 464 for audible signal appliances (Indoor use only).
- **“Regulated Voltage Range” is the newest terminology used by UL to identify the voltage range. Prior to this change UL used the terminology “Listed Voltage Range”.**

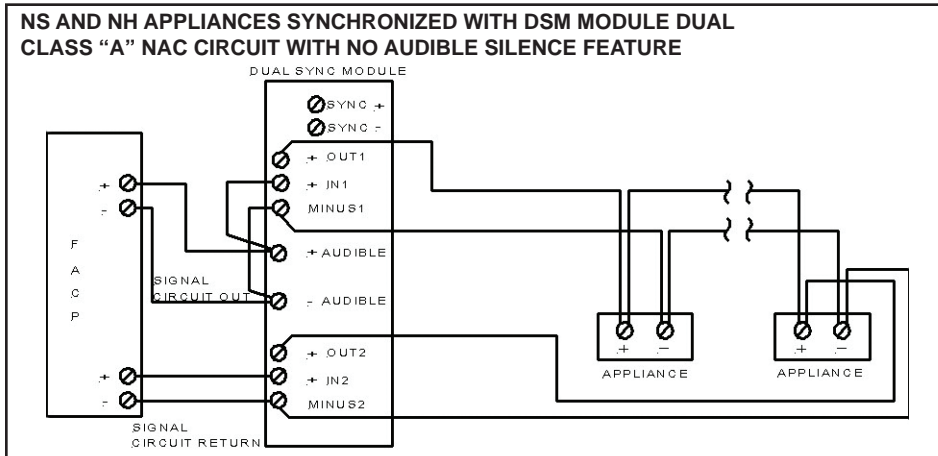
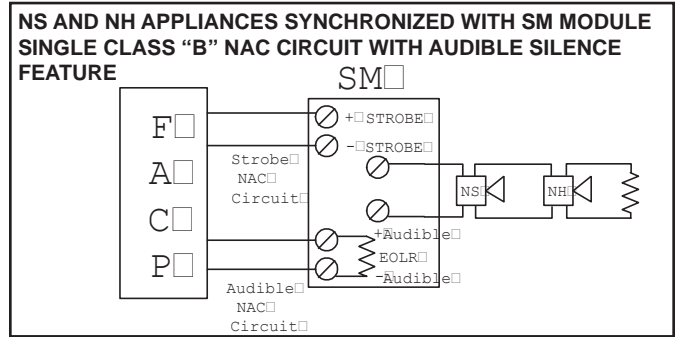
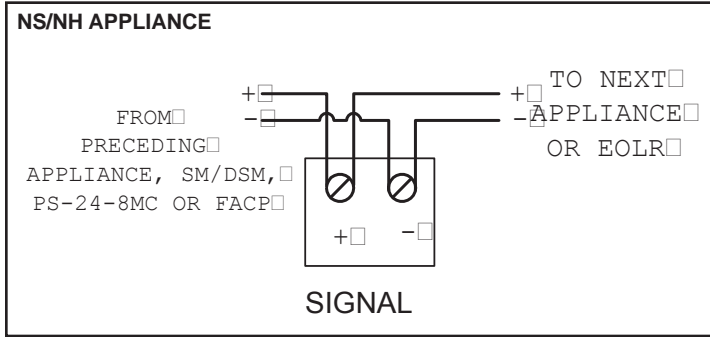
Model	Input Voltage VDC	Regulated Voltage Range VDC/FWR	Strobe Candela (CD)
NS-24MCW	24	16.0 - 33.0	15/30/75/110
NS-241575W	24	16.0 - 33.0	15 (75 on Axis)
NS-121575W	12	8.0 - 17.5	15 (75 on Axis)
NS-24MCC	24	16.0 - 33.0	15/30/75/95
NS-24MCCH	24	16.0 - 33.0	115/177

Description	Volume	Reverberant dBA @ 10ft per UL 464		Anechoic dBA @ 10 ft	
		12 VDC	24 VDC	12 VDC	24 VDC
Continuous Horn	High	83	87	89	95
	Low	76	81	84	90
Code 3 Horn	High	79	82	89	95
	Low	72	76	84	90

Series NS/NH 24 VDC		Audible	Wall Mount Strobe Models					Ceiling Mount Strobe Models					
		NH-12/24	NS-241575W	NS-24MCW				NS-24MCC				NS-24MCCH	
		@24VDC	15/75cd	15cd	30cd	75cd	110cd	15cd	30cd	75cd	95cd	115cd	177cd
High (95) dBA	<b>24VDC</b>	0.044	0.104	0.074	0.107	0.184	0.244	0.082	0.124	0.209	0.275	0.350	0.477
Low (90) dBA	<b>24VDC</b>	0.018	0.096	0.066	0.101	0.177	0.232	0.071	0.114	0.201	0.261	0.306	0.429
Series NS/NH 12VDC		Audible	Wall Mount	* RMS current ratings are per UL average RMS method. UL max current rating is the maximum RMS current within the listed voltage range (16-33v for 24v units). For strobes the UL max current is usually at the minimum listed voltage (16v for 24v units). For audibles the max current is usually at the maximum listed voltage (33v for 24v units). For unfiltered FWR ratings, see installation instructions.									
		NH-12/24	Aud/Strobe										
		@12V	NS-121575W										
High (89) dBA	<b>12 VDC</b>	0.021	0.220										
Low (84) dBA	<b>12VDC</b>	0.012	0.210										



## Wiring Diagrams#



**NOTE: NS/NH must be set on Code 3 horn tone to achieve synchronized temporal (Code 3) tone. Refer to installation instruction (P83983, P83600 respectively).**

# For detail using SM or DSM Sync Module refer to Data Sheet S3000 or Installation Instructions P83123 for SM and P83177 for DSM. For wiring information on the power supplies refer to Installation Instructions P84662 for PS-24-8MC.

## SPECIFICATION & ORDERING INFORMATION

Model Number	Order Code	Strobe Candela	Sync w/ SM, DSM or PS-24-8MC	24 VDC	12 VDC	Mounting Options#	Agency Approvals				
							UL	MEA	CSFM	FM	BFP
NS-24MCW-FR	9404	15/30/75/110	X	X	-	B,D,E,F,G,H,J,N,O,R,X	X	X	X	X	X
NS-24MCW-FW	9405	15/30/75/110	X	X	-	B,D,E,F,G,H,J,N,O,R,X	X	X	X	X	X
NS-241575W-FR	7806	15 (75 on Axis)	X	X	-	B,D,E,F,G,H,J,N,O,R,X	X	X	X	X	X
NS-241575W-FW	7811	15 (75 on Axis)	X	X	-	B,D,E,F,G,H,J,N,O,R,X	X	X	X	X	X
NS-121575W-FR	7816	15 (75 on Axis)	X	--	X	B,D,E,F,G,H,J,N,O,R,X	X	X	X	X	X
NS-121575W-FW	7818	15 (75 on Axis)	X	-	X	B,D,E,F,G,H,J,N,O,R,X	X	X	X	X	X
NH-12/24-R	7449	-	X	X	X	B,D,E,F,G,H,J,N,O,R,X	X	X	X	X	X
NH-12/24-W	7500	-	X	X	X	B,D,E,F,G,H,J,N,O,R,X	X	X	X	X	X
NS-24MCC-FR	3754	15/30/75/95	X	X	-	E	X	*	X	X	*
NS-24MCC-FW	3753	15/30/75/95	X	X	-	E	X	*	X	X	*
NS-24MCCH-FR	3756	115/177	X	X	-	E	X	*	X	X	*
NS-24MCCH-FW	3755	115/177	X	X	-	E	X	*	X	X	*
NH-12/24R-R	3752	-	X	X	X	D & E	X	*	X	X	*
NH-12/24R-W	3751	-	X	X	X	D & E	X	*	X	X	*

\*Pending

Note: Models are available in Red or White. Contact Customer Service for Order Code and Delivery.  
#Refer to Data Sheet S7000 for Mounting Options

**NOTE: Due to continuous development of our products, specifications and offerings are subject to change without notice in accordance with Wheelock Inc. standard terms and conditions.**

## ARCHITECTS AND ENGINEERS SPECIFICATIONS

The audible/visual notification appliances shall be Wheelock Series NS Horn Strobe appliances and Series NH Horn appliances or approved equals. The Series NS appliances shall meet and be listed for UL Standard 1971 (Emergency Devices for the Hearing-Impaired for Indoor Fire Protection Service). The Series NH Horn shall be UL Listed under Standard 464 (Fire Protective Signaling). The horn strobe shall be listed for indoor use and shall meet the requirements of FCC Part 15 Class B. All inputs shall be compatible with standard reverse polarity supervision of circuit wiring by the Fire Alarm Control Panel (FACP).

The audible portion of the appliance shall have a minimum of two (2) field selectable settings for dBA levels (90 and 95 dBA) and shall have a choice of continuous or temporal (Code 3) audible outputs.

The strobe portion of the appliance shall produce a flash rate of one (1) flash per second over the Regulated Voltage Range and shall incorporate a Xenon flashtube enclosed in a rugged Lexan lens. The Series NS shall be of low current design. Where wall mount, Multi-Candela appliances are specified, the strobe intensity shall have field selectable settings and shall be rated per UL Standard 1971 for 15/30/75/110 candela. Where ceiling mount, Multi-Candela appliances are specified, the strobe intensity shall have field selectable settings and shall be rated per UL Standard 1971 for 15/30/75/95 candela or 115/177 candela. The selector switch for selecting the candela setting shall be tamper resistant. The 1575 candela strobe shall be specified when 15 candela UL Standard 1971 Listing with 75 candela on-axis is required (e.g. ADA compliance).

When synchronization is required, the appliance shall be compatible with the Wheelock SM, DSM Sync Modules, Wheelock Power Supplies or other manufacturers panels with built-in Wheelock Patented Sync Protocol. The strobes shall not drift out of synchronization at any time during operation. If the sync module or Power Supply fails to operate, (i.e., contacts remain closed), the strobes shall revert to a non-synchronized flash-rate. The appliance shall also be designed so that the audible signal may be silenced while maintaining strobe activation.

The Series NS Horn Strobes and NH horn shall incorporate a Patented Universal Mounting Plate that shall allow mounting to a single-gang, double-gang, 4-inch square, 100mm European type backboxes, or the SHBB Surface Backbox. If required, an NATP (Notification Appliance Trimplate) shall be provided.

All notification appliances shall be backward compatible.



WE ENCOURAGE AND SUPPORT NICET CERTIFICATION  
3 YEAR WARRANTY  
Made in USA

**S2100 NS/NH 2/08**

### NJ Location

273 Branchport Ave.  
Long Branch, NJ 07740  
P: 800-631-2148  
F: 732-222-8707  
[www.coopernotification.com](http://www.coopernotification.com)

### FL Location

7565 Commerce Ct.  
Sarasota, FL 34243  
P: 941-487-2300  
F: 941-487-2389

### VA Location

2009 North 14th St., Ste. 510  
Arlington, VA 22201  
P: 877-459-7726  
F: 703-294-6560

Cooper Notification is Wheelock®



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**COOPER**Notification

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# LISTING SERVICE

**LISTING No.** 7272-0067:0203

Page 1 of 1

**CATEGORY:** 7272 -- PHOTOELECTRIC SMOKE DETECTOR

**LISTEE:** Siemens Industry, Inc. Building Technologies Division, 8 Fernwood Road, Florham Park, NJ 07932  
Contact: Peter Pawchak (973) 593-2662 Fax (973) 593-6652  
Email: Peter.pawchak@siemens.com

**DESIGN:** Models FP-11, HFP-11, and \*HFPO-11 analog and FPO-11 photoelectric type smoke detectors. Models FP-1, and HFP-11 also have a supplemental 1350F heat sensor. Model DGH-11 detector guard housing suitable for use with Models HFP-11, \*HFPO-11 and FP-11 smoke detectors. Refer to listee's data sheet for additional detailed product description and operational considerations.

**RATING:**

**INSTALLATION:** In accordance with listee's printed installation instructions, applicable codes & ordinances and in a manner acceptable to the authority having jurisdiction. These detectors are intended for installation on a vertical wall surface or the ceiling. They are also acceptable for duct application with an air velocity of 0-4000 ft/min. when used with Models DB-11, DB-HR or DB-X11RS bases.

**MARKING:** Listee's name, model number, and UL label.

**APPROVAL:** Listed as photoelectric type smoke detectors for use with listee's separately listed base Model DB-11, DB-HR or DB-X11RS (CSFM Listing No. 7300-0067:134) and separately listed compatible fire alarm control units. Model DGH-11 detector guard housing is listed for use only with FP-11 and HFP-11. Refer to listee's Installation Instruction Manual for details.

**NOTE:**

\*Rev. 09-27-2004



This listing is based upon technical data submitted by the applicant. CSFM Fire Engineering staff has reviewed the test results and/or other data but does not make an independent verification of any claims. This listing is not an endorsement or recommendation of the item listed. This listing should not be used to verify correct operational requirements or installation criteria. Refer to listee's data sheet, installation instructions and/or other suitable information sources.

Date Issued: **July 01, 2010**

Listing Expires **June 30, 2011**

Authorized By: **FRANCIS MATEO**, Program Coordinator  
Fire Engineering Division



CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION  
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# LISTING SERVICE

**LISTING No.** 7270-0067:0202 Page 1 of 1

**CATEGORY:** 7270 -- HEAT DETECTOR

**LISTEE:** Siemens Industry, Inc. Building Technologies Division, 8 Fernwood Road, Florham Park, NJ 07932  
Contact: Peter Pawchak (973) 593-2662 Fax (973) 593-6652  
Email: Peter.pawchak@siemens.com

**DESIGN:** Model FPT-11 electronic fixed temperature heat detector. Refer to listee's data sheet for additional detailed product description and operational considerations.

**RATING:** 1350F fixed temperature

**INSTALLATION:** In accordance with listee's printed installation instructions, applicable codes & ordinances and in a manner acceptable to the authority having jurisdiction.

**MARKING:** Listee's name or Cerberus Pyrotronics, model number, temperature rating and UL label.

**APPROVAL:** Listed as heat detector for use with separately listed compatible fire alarm control units. Intended for use with listee's Model DB-11 base (CSFM Listing No. 7300-0067:134).

**NOTE:**

\*Rev. 10-26-2002



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Date Issued: **July 01, 2010**

*Listing Expires* **June 30, 2011**

Authorized By: **FRANCIS MATEO**, Program Coordinator  
*Fire Engineering Division*



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# LISTING SERVICE

**LISTING No.** 7300-0067:0134

Page 1 of 1

**CATEGORY:** 7300 -- MISC. DEVICE/CONTROL UNIT ACCESSORIES

**LISTEE:** Siemens Industry, Inc. Building Technologies Division, 8 Fernwood Road, Florham Park, NJ 07932  
Contact: Peter Pawchak (973) 593-2662 Fax (973) 593-6652  
Email: Peter.pawchak@siemens.com

**DESIGN:** Models DB4T, DB4TS, DB4F, DB4TF, DB4FS, DB3S, ADB3, ADBX3, DB-HR, DBX3RS, DB-11, DB-X11RS, ADBI60, ADB-11, ADBH-11, ADBX-11 and 8837 detector bases and Model DB-ADPT detector/base adapter. Suitable for use with Models RR2 or RR3 auxiliary relays. Model DB-11 is suitable for use only with Model RR-11 or RR-11F auxiliary relay. Models DB-11 base, ADBH-11 audible base, and DB-HR relay base are intended to be used with Models HFP-11 and HFPT-11 Intelligent Series smoke and heat detectors (CSFM Listing No. 7272-0067:223 and 7270-0067:224). Refer to listee's data sheet for additional detailed product description and operational considerations.

**RATING:**

**INSTALLATION:** In accordance with listee's printed installation instructions, applicable codes & ordinances and in a manner acceptable to the authority having jurisdiction. Model DB-11, ADBH-11 and DB-HR may be installed on the ceiling or on the wall.

**MARKING:** Listee's name or Cerberus Pyrotronics, model number, electrical rating and UL label.

**APPROVAL:** Listed as detector bases for use with separately listed compatible smoke detector heads and fire alarm control units.

**NOTE:**

\*Rev. 10-28-2002 JW



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Date Issued: **July 01, 2010**

Listing Expires **June 30, 2011**

Authorized By: **FRANCIS MATEO**, Program Coordinator  
Fire Engineering Division





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# LISTING SERVICE

**LISTING No.** 7150-0067:0036

Page 1 of 1

**CATEGORY:** 7150 -- FIRE ALARM PULL BOXES

**LISTEE:** Siemens Industry, Inc. Building Technologies Division, 8 Fernwood Road, Florham Park, NJ 07932  
Contact: Peter Pawchak (973) 593-2662 Fax (973) 593-6652  
Email: Peter.pawchak@siemens.com

**DESIGN:** Models MS-5, -51, -52, -52C, -53 through -57, -60, -60DAP, -60DP, -60KS, -151, -157, -500 through -507, -511, -512, -512C, -513, -513C, -514, -514C, -515, -516, -517, -517C, -518, and MS-MI; MH-51, -57, -501, -507, -511, -517, -517C, -518; MSX-1, -2, -2D, -100; MHX-1, -100; MSI-1, -2, -10, -10B, -20, -20B, -60, -60DA; MSI-MB6; HMS-S, -D, -M noncoded manual pull stations. Single action, double action, and double action distinct type. Refer to listee's data sheet for additional detailed product description and operational considerations.

**RATING:**

**INSTALLATION:** In accordance with listee's printed installation instructions, applicable codes & ordinances and in a manner acceptable to the authority having jurisdiction.

**MARKING:** Listee's name or Cerberus Pyrotronics, model number, electrical rating and UL label.

**APPROVAL:** Listed as manual pull stations for use with separately listed electrically compatible fire alarm control units. Models with prefix MH are suitable for use with Halon extinguishing system. Models HMS-S, -D, -M are addressable.  
\* These manual pull boxes do not meet the requirements of UL Standard 38, 1999 Edition and California amendments.

**NOTE:**

\*Updated 06-22-2009 fm



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Date Issued: **July 01, 2010**

Listing Expires **June 30, 2011**

Authorized By: **FRANCIS MATEO**, Program Coordinator  
Fire Engineering Division



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# LISTING SERVICE

**LISTING No.** 7125-0785:0131

Page 1 of 2

**CATEGORY:** 7125 -- FIRE ALARM DEVICES FOR THE HEARING IMPAIRED

**LISTEE:** Cooper Wheelock Inc., 273 Branchport Ave, Long Branch, NJ 07740  
Contact: Raylon Smith (732) 962-7832 Fax (732) 962-7856  
Email: raylon.smith@cooperindustries.com

**DESIGN:** Models AS-1215, -2415, -1230, -2430, -121575, -241575, -2475 and -24110  
audible/strobes for the hearing impaired followed by any three alpha/numeric characters  
indicating lens orientation, lettering and color.

Models AS-1215W, -2415W, -1230W, -2430W, -121575W, -241575W, -2475W and  
-24110W audible/strobes for the hearing impaired followed by any three alpha/numeric  
characters indicating lens orientation, lettering and color. These units with suffix -W are for  
wall mount only. \*Models AS-121575W and AS-241575W lens color may be white, red,  
blue, green, or amber.

Models AS-2415C, -2430C, -2475C and -24100C audible/strobes for the hearing impaired  
followed by two alpha/numeric characters indicating lens lettering, orientation and color.  
These units are intended for ceiling mount only.

Model AH-12, -24, AH-12WP, -24WP audible appliances (no strobe), followed by an alpha  
or numeric character indicating product color.

Model AS-24MCW and AS-24MCC audible/strobe, followed by any two alpha or numeric  
character indicating lettering and product color. \*Lens color may be white, red, blue, green,  
or amber.

Models ASWP-2475W and \*ASWP-2475C audible/strobe with integral private mode  
fire/emergency visual signaling for non-hearing impaired applications. Lens color may be  
white, red, blue, green, and amber. Both models are suitable for outdoor use when  
mounted on the Model WPBB back box.

Models AS-24MCWH, AS-24MCCH, \*ASWP-24MCWH, and \*ASWP-24MCCH  
audible/strobes for the hearing impaired followed by two alpha/numeric characters  
indicating lens lettering and product color. Units with suffix CH are for ceiling mount only.  
Units with suffix WH are for wall mount only. \*Lens color may be white, red, blue, green, or  
amber.

Refer to the listee's data sheet for detailed product description and operational  
considerations.

**RATING:** Electrical: 8-17.5/16-33 VDC/VFWR

\*Rev. 10-01-07



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Date Issued: **July 01, 2010**

Listing Expires **June 30, 2011**

Authorized By: **FRANCIS MATEO**, Program Coordinator  
Fire Engineering Division



Flash Rate: 60 flashes/minute

Candela: 15:15cd,1575:15/75cd,30:30cd,75:75cd,95:95cd,100:100cd,110:110cd

MCW: Selectable 15cd, 30cd, 75cd,110cd

MCC: Selectable 15cd, 30cd,75cd,95cd

MCWH: Selectable 135cd,185cd (65cd, 90cd at -40 C)

MCCH: Selectable 115cd,177cd (50cd, 75cd at -40 C)

**INSTALLATION:** In accordance with listee's printed installation instructions, applicable codes and ordinances and in a manner acceptable to the authority having jurisdiction. Models ASWP-2475W, ASWP-24MCWH, AS-24MCW and AS-24MCWH are for wall mount only. Models ASWP-2475C, ASWP-24MCCH, AS-24MCCH, AND AS-24MCC are for ceiling mount only. Models with suffix -W or WH are for wall mount only. Models with suffix -C or -CH are for ceiling mount only.

**MARKING:** Listee's name, model number, electrical/candela rating, and UL label.

**APPROVAL:** Listed as audible and audible/visual signaling devices suitable for the hearing impaired when used in conjunction with separately listed electrically compatible fire alarm control units. For indoor use only except Models AH-12WP, AH-24WP, \*ASWP-2475W, ASWP-2475C, ASWP-24MCWH, and ASWP-24MCCH audible appliances are suitable for indoor/outdoor. For synchronization, Models AS Series must be used with Model SM-12/24, SMX-12/24, DSM-12/24 or DSMX-12/24 sync control module (CSFM Listing No. 7300-0785:132). Refer to listee's Installation Instruction Manual for details. These appliances can generate a distinctive three-pulse Temporal Pattern Fire Alarm Evacuation Signal (for total evacuation) in accordance with NFPA 72, 2002 Edition.

**NOTE:** Models AH-12, AH-24, -12WP and -24WP audible devices are not suitable for the hearing impaired applications.

\*Rev. 10-01-07



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Date Issued: **July 01, 2010**Listing Expires **June 30, 2011**Authorized By: **FRANCIS MATEO, Program Coordinator***Fire Engineering Division*



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# LISTING SERVICE

**LISTING No.** 7125-0785:0142  
**CATEGORY:** 7125 -- FIRE ALARM DEVICES FOR THE HEARING IMPAIRED

Page 1 of 1

**LISTEE:** Cooper Wheelock Inc., 273 Branchport Ave, Long Branch, NJ 07740  
Contact: Raylon Smith (732) 962-7832 Fax (732) 962-7856  
Email: raylon.smith@cooperindustries.com

**DESIGN:** Models NH-12/24, NH-12/24R, and ZNH horns and Models NS-1215W, NS-121575W, NS-2415W, NS-241575W, NS-2430W, NS-2475W and NS-24110W; NS4-1215W, NS4-121575W, NS4-2415W, NS4-241575W, NS4-2430W, NS4-2475W and NS4-24110W, NS-24MCW, NS4-24MCW, NS-24MCC, NS-24MCCH, ZNS-MCW, ZNS-MCC, ZNS-MCWH and ZNS-MCCH horn strobes. Model number may be followed by any two-alpha/numeric characters indicating lens, lettering and color. Units are synchronized or non-synchronized strobes. Models NH-12/24R, NS-24MCC, NS-24MCCH, ZNS-MCC and ZNS-MCCH are ceiling mount only. Refer to listee's data sheet for additional detailed product description and operational considerations.

**RATING:** Electrical-Strobe Horn: 8-17.5 VDC/FWR and 16-33 VDC/FWR  
Horn: 8-17.5 VDC/FWR and 16-33 VDC/FWR  
Candela: 15=15cd, 1575=15/75cd on axis, 30=30cd, 75=75cd, 110=110cd (Wall)  
NS-24MCW, NS4-24MCW, ZNS-MCW: Selectable 15cd, 30cd, 75cd, 110cd  
NS-24MCC, ZNS-MCC: Selectable 15cd, 30cd, 75cd, 95cd  
NS-24MCCH, ZNS-MCCH: Selectable 115cd, 177cd  
ZNS-MCWH: Selectable 135cd, 185cd  
Flash rate: 60 Flashes/minute

**INSTALLATION:** In accordance with listee's printed installation instructions, applicable codes & ordinances and in a manner acceptable to the authority having jurisdiction. All units are for wall mount except for \*Models NH-12/24R, NS-24MCC, NS-24MCCH, ZNS-MCC and ZNS-MCCH are for ceiling mount only.

**MARKING:** Listee's name, model number, electrical/candela rating and UL label.

**APPROVAL:** Listed as audible and audible/visual signaling devices for use with separately listed electrically compatible fire alarm control units. Models with strobe lights are suitable for the hearing impaired. For indoor use only except for model NH-12/24 horn. All synchronization strobes shall be used with Models SM-12/24, SMX-12/24, DSM-12/24 or DSMX-12/24 Sync Control Module (CSFM Listing No. 7300-0785:132). Refer to manufacturer's installation manual for details.

**NOTE:** These appliances can produce a distinctive three-pulse Temporal Pattern Fire Alarm Evacuation Signal (for total evacuation) in accordance with NFPA 72, 2002 Edition.

\*Corrected 07-25-08 bh



This listing is based upon technical data submitted by the applicant. CSFM Fire Engineering staff has reviewed the test results and/or other data but does not make an independent verification of any claims. This listing is not an endorsement or recommendation of the item listed. This listing should not be used to verify correct operational requirements or installation criteria. Refer to listee's data sheet, installation instructions and/or other suitable information sources.

Date Issued: **July 01, 2010**

Listing Expires **June 30, 2011**

Authorized By: **FRANCIS MATEO**, Program Coordinator  
Fire Engineering Division



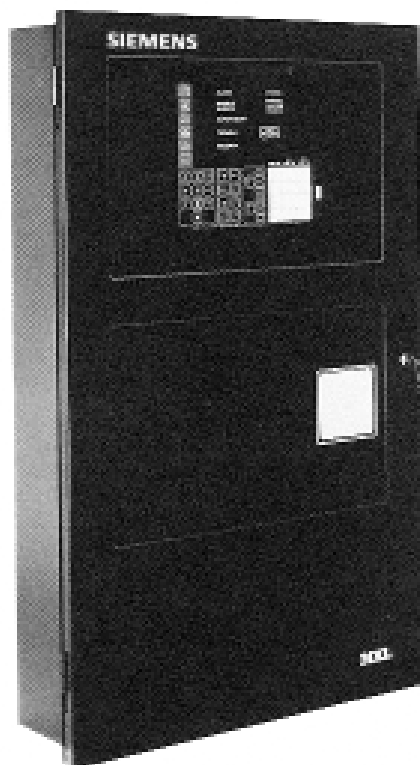


## MXL

### Advanced Protection System

#### ENGINEER AND ARCHITECT SPECIFICATIONS

- **FirePrint™** Application Specific Detection
- Capacity for over 2,000 Intelligent Input Devices
- Dynamic Supervision of Intelligent Devices
- Security Device Monitoring
- Sprinkler Supervision
- Intelligent/Analog Detection Circuits, Style 6 (Class A) or Style 4 (Class B)
- Detector Sensitivity Readout/Printout per NFPA 72 Chapter 7
- Style D (Class A) or Style B (Class B) Conventional Initiating Circuits
- Style Z (Class A) or Style Y (Class B) Notification Appliance Circuits
- Degrade Mode Operation
- Distributed Processing
- 80 Character Backlit Alphanumeric Display
- Thermal Strip Printer
- Supervised Remote Printer
- 32 Character Custom Messages
- Multiple Command Stations
- **Compare System Software**
- Fully Field Programmable Via Laptop Computer
- Menu Driven Operator Commands
- Central & Distributed Architecture
- 800 Event History Logging With On Line & Off Line Reports
- User Help Screens
- Multiple Levels of Password Protection
- Automatic Environmental Compensation for Smoke Detectors
- One Person Walk Test by Loop, Zone or System
- Alarm Verification by Device or Zone



**UUKL Listed for Smoke Control**

- Logic Controlled Output Functions
- Time Base Controlled Output Functions
- Holiday Schedule
- City Tie/Lease Line
- Coded Outputs
- Supervised Serial Annunciator Driver/Input Interface
- Interactive VDT - Monochrome & Color
- Color Graphics Option
- Complies with NFPA 72
- NEC 760 Power Limited Circuits (UL 864 Compliant)
- 16 Gauge Steel Enclosure
- **UL Listed 864, 1076, ULC Listed**
- **FM, CSFM, NYMEA, City of Chicago and U.S. Coast Guard Approved**
- Pre-action Releasing (NFPA 13)
- **FM** Approved for Sprinkler & Deluge
- **FM** Approved for Intrinsically Safe Applications
- Halon & Sinorix™ Releasing Approval (NFPA 12A & NFPA 2001)
- Multi-Language Display
- Intelligent Interface to Building/Process Management Systems
- Operates as an Interactive Peer with Other MXLs, MXL-IQs or MXLVs in a **LifeLink** Network
- CXL Command Center Monitoring
- Pre-Alarm Operation
- **FireFinder** Graphics

### Introduction

The MXL is a microprocessor based advanced protection system. Its use of unique multiprocessor "Network" design along with its ability to utilize both analog and conventional detection devices make it the most flexible and reliable system in the life safety field.

The MXL is ideally suited for commercial, institutional and industrial fire detection and notification applications. It complies with the requirements of NFPA Standard 72 and is listed by Underwriters Laboratories under their standard 864. Underwriter's Laboratories of Canada also lists it for fire applications. It is

approved by Factory Mutual as well as CSFM, the City of Chicago and NYMEA for use in those specific locales.

In addition to the standard fire applications, MXL is listed by Underwriters Laboratories under the category UUKL for smoke control. MXL can be used as a listed Fireman's Smoke Control Station in high-rise office building, malls and other large structures. It also complies with Uniform Building Code Section 905 requirements for smoke control.

MXL is approved by the US Coast Guard for marine applications such as ships and oil drilling platforms. It is listed by UL and approved by FM for releasing Halon 1301, Sinorix™ clean agent systems and pre-action or deluge sprinkler systems. These include foam or water applications. MXL follows the releasing requirements specified in the NFPA Standards 12A, 13 and 2001.

## Description

The basic MXL control unit consists of the following subassemblies: MMB-2 Main Control Board; MPS-6, MPS-12 Power Supply; MKB-2 Annunciator and Keyboard; MME-3, MLE-6 or MSE-2 Enclosures. Optional modules which can be installed with the MXL System include: MOM-2/4 Expansion Card Cage; ALD-2I Analog Loop Driver; CRM-4 Controllable Relay Module; NIM-1W Network/Foreign Systems Interface Module; REP-1 Network Repeater Module; XLD-1 "X" Series Loop Driver; CSM-4 Controllable Signal Module; CZM-4 Conventional Zone Module; PIM-1 Peripheral Interface Driver; CMI-300 CXL Modem Interface Module; PSR-1 Remote Power Supply; MXL-VDT Interactive Video Display Terminal; NET-4 Style 4 Network Interface; NET-7 Style 7 Network Interface.

Additionally, the MXL system includes option modules MOI-7 System Interface, MOD-16 Output Driven and MID-16 Point Input Module. These can be used to drive graphic annunciators and Fireman's Smoke Control Stations or to monitor foreign systems.

The MXL is compatible with a full line of intelligent initiating devices highlighted by the FirePrint Application Specified Detectors, models FP-11 and FPT-11. It is also compatible with FireFinder, the NCC series of text and graphic command centers.

### MMB-2 Main Control Board

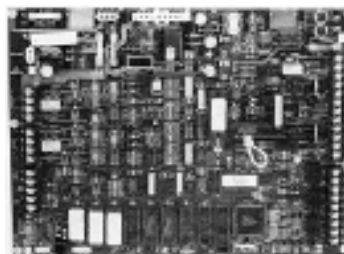
The function control of the MXL is contained on the MMB-2 Main Control Board. The MMB-2 controls, operates and monitors input device identity, network communications as well as operator commands that are entered through the MKB annunciator/keyboard. All operations are supported by either the MPS-6 or the MPS-12 power supply, eliminating the need for external power supplies. The MMB-2 is a direct replacement of the MMB-1 therefore providing total backward compatibility.

The MMB-2 provides 2 ALD (Analog Loop Driver) circuits. Each ALD loop can be configured as Style 4 (Class B) or Style 6 (Class A) and can monitor and control up to 60 Siemens Building Technologies, Fire Safety Division intelligent input devices and 60 programmable outputs, either relay, audible or LED. The MMB-2 is equipped with 2 programmable and codable Style Y (Class B) or Style Z (Class A) notification appliance circuits. Each circuit Fire Safety can activate up to 1.5 amps of audible and visual notification appliances.

The MMB-2 includes a built-in battery charger and transfer circuit. The charger is microprocessor controlled and incorporates a brownout circuit that switches the system to standby batteries during the loss and reduction of the primary source AC. Upon command, the system is capable of displaying the real time, battery voltage, AC voltage and the charge current and other power data on the MKB alphanumeric display. It also has a 1 amp, 24 VDC output that powers the CZM-1 conventional zone modules.

The MMB-2 is designed with a built-in mounting bracket. The MMB-2 mounts directly to the MBR-MP mounting plate for mounting in either the MME-3 or MME-6 backbox enclosure. The MMB-2 can also be mounted in the MBR-2 or MBR-1 enclosures. MBR-1 requires additional mounting brackets.

The on-board 16 bit microprocessor along with nonvolatile EPROM and Flash memory allow the system to be custom configured to meet a wide range of customer requirements. The MMB-2 provides a port for connection to a laptop computer allowing for off-line field programming. Complete system configuration can be easily uploaded, downloaded, edited and changes verified using CSGM custom programming software with integrated Compare™ system software. Program options include but are not limited to smoke detector environmental compensation with two maintenance alert levels, history logging, output control by event, time based control, detector sensitivity, alarm verification by device or zone, 32 character custom alphanumeric messages, system operation passwords and NAC coding.



MMB-2

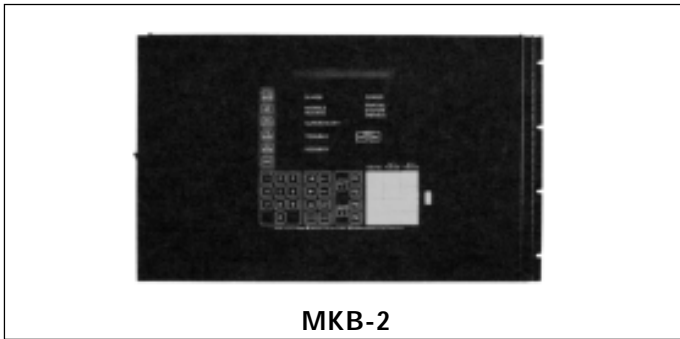
### MKB-2 Annunciator/Keypad

The MKB-2 mounts on a hinged frame in the MXL enclosure and provides an 80 character backlit LCD alphanumeric annunciator which continuously scrolls to display information concerning system status along with 32 character user defined device messages. When multiple events occur, the MKB-2 displays the last event of the highest priority. Additional data can be viewed by depressing the NEXT key. At any time, the display scroll can be stopped by depressing the HOLD button. Switches are provided for acknowledging fire alarms, supervisories, security conditions, and system troubles. An individual switch is also provided for silencing the system notification appliance circuits. A separate switch is used for resetting the control panel.

A 10 digit numeric keypad is supplied to allow entry of the user passwords, as well as perform specific menu driven operation, programming and maintenance functions. Another series of switches located on the MKB-2 allows user access to the TSP-40 Thermal Strip Printer, when used.

A set of user assignable "Function" keys provide single button access to a variety of system commands. These switches may be used to perform system operation such as "Drill," manual relay control, zone disconnect, etc. Contained on the MKB-2 annunciator are system status indicator LED's which can function even if the main system microprocessor fails. They provide indication of Main Power On, Fire Alarm, Security Condition, System Trouble, Super-visories, System Audibles Active/Silenced and Partial System Disable.

The MKB-2 Annunciator communicates with the MMB-2 Main Control Board through the system network link.



**MKB-2**

**MPS-6 Power Supply**

The MPS-6 is a fully supervised power supply which provides the system with primary DC power. It is rated at 6.5 Amps and is unfiltered and unregulated. It supplies the MXL Control Unit and its expansion modules with power required for normal operation. The unit incorporates a circuit breaker on the primary input and includes a built in AC line filter for surge and noise suppression. The MPS-6 mounts in the MXL enclosure backbox.



**MPS-6**

**MPS-12 Power Supply**

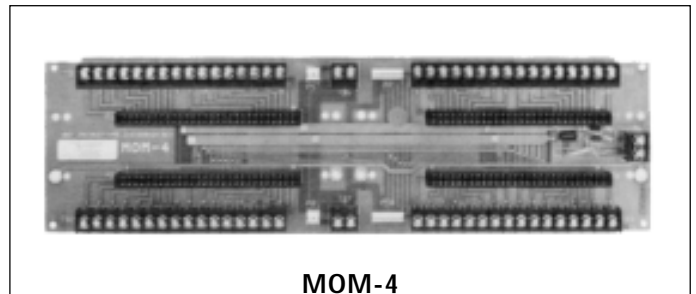
The MPS-12 is a fully supervised power supply which provides the system with preliminary DC power. It is rated at 12 Amps. and is unfiltered and unregulated. It supplies the PSR-1, MMB-2 and their expansion modules with power required for normal operation. The unit incorporates a resettable circuit breaker on the primary input and includes a built-in AC line filter for surge and noise suppression. The MPS-12 mounts in the MXL enclosure backbox.



**MPS-12**

**MOM-4 Network Option Module Card Cage**

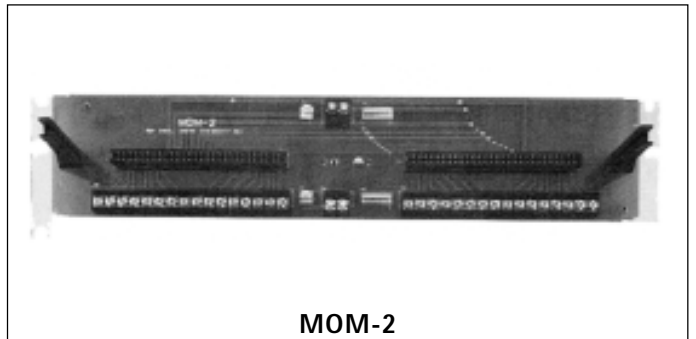
The MOM-4 Card Cage provides the MXL Main Unit or Remote Units with card slots for option modules. Each MOM-4 supplies connection space for either two full width option modules (ALD-2I, CZM-4, NIM-1R, XLD-1) or four half width option modules (CSM-4, CRM-4, CMI-300, NET-7, REP-1) or a combination of one full and two half width modules.



**MOM-4**

**MOM-2 Network Option Module Card Cage**

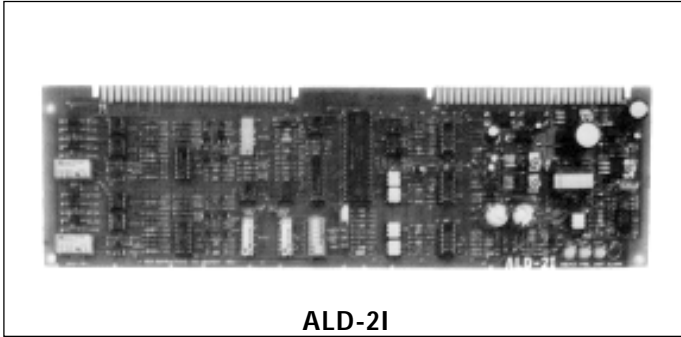
The MOM-2 provides the MXL main unit, remote units or MXL small enclosures (MSE-2) with card slots for optional modules. Each MOM-2 provides space for one full-width (ALD-2I, CZM-4, NIM-1R) or two half-width optional modules (CSM-4, CRM-4, CMI-300, NET-7, REP-1).



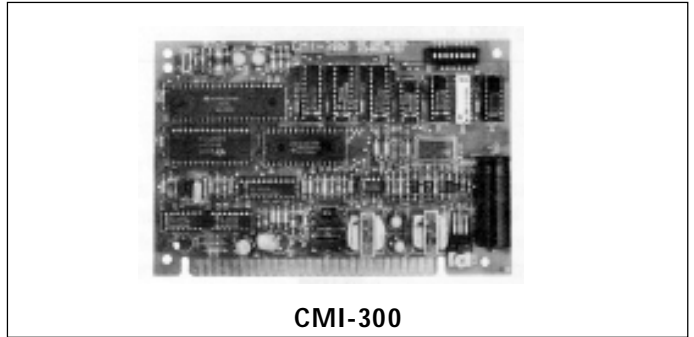
**MOM-2**

**ALD-2I Analog Loop Driver**

The ALD-2I is an MXL Network option module which supplies two intelligent analog circuits utilizing Fire Safety "I," "IL," and FP series intelligent devices. It occupies two addresses on the Network and through the use of a unique communication protocol, devices connected to the ALD-2I circuits are dynamically supervised by the MXL control panel. Up to 60 programmable input and output devices may be connected to each of its two circuits. Each circuit may be wired as Class B (Style 4) or Class A (Style 6).



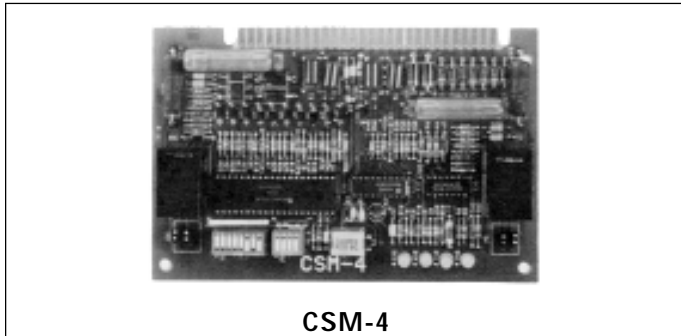
**ALD-21**



**CMI-300**

**CSM-4 Controllable Signal Module**

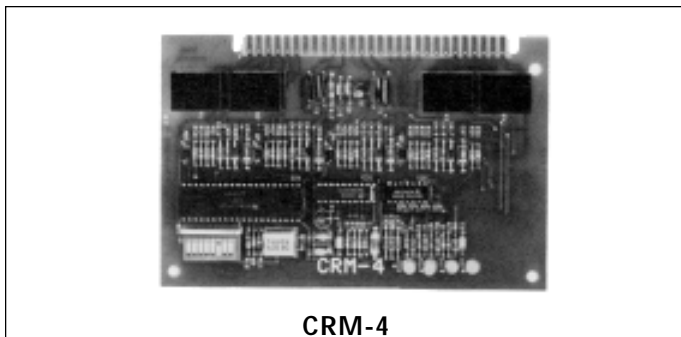
The Controllable Signal Module CSM-4 provides two fully supervised, programmable notification appliance circuits. The CSM-4 supplies two Class B (Style Y) or Class A (Style Z) type output circuits for the supervision and control of listed audible or visual notification appliances such as horns, bells, strobes, etc. Each circuit can provide up to 1.5 amps (24 VDC) of current to power notification appliances. The CSM-4 is also used for extinguishing agent releasing (Sinorix™, Halon, Pre-Action Sprinkler and Deluge systems). Leased line and municipal tie connections are also possible with the CSM-4.



**CSM-4**

**CRM-4 Controllable Relay Module**

The Controllable Relay Module CRM-4 is designed to provide auxiliary control of building functions such as door holder release, elevator capture, smoke control, lock release, etc. It provides four fully programmable relays. Each relay contains one set of SPDT contacts rated at 2 amps 30 VDC/120 VAC resistive.



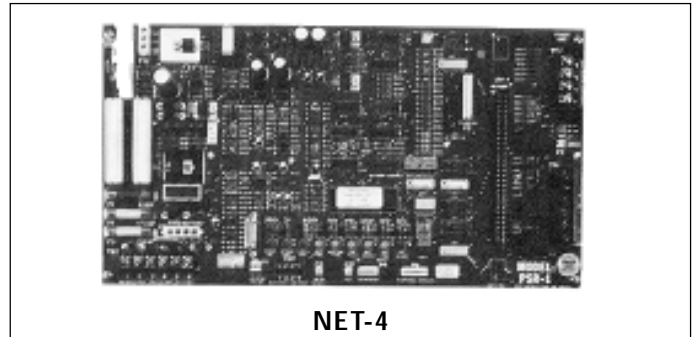
**CRM-4**

**CMI-300 CXL/MXL Interface Module**

The CMI-300 is an MXL option module which provides modem communication between an MXL and a CXL command center. This interface board translates signals between the MXL network and a CXL and fully supervises their interconnection.

**NET-4 Communication Module**

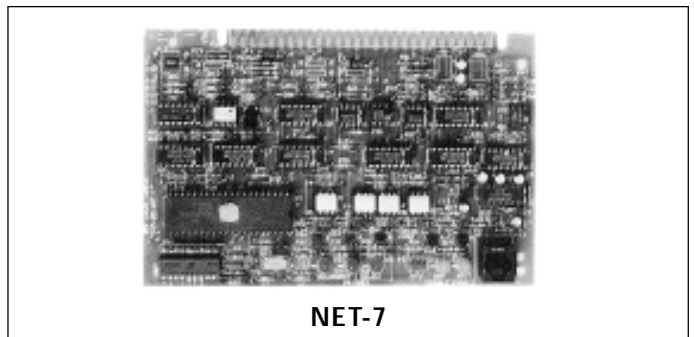
The NET-4 is a plug-in type module used to provide communication between the Fire Safety MXL and various other MXL Remote Modules. It is designed to plug into an edge connector type slot on the PSR-1 Network Supply. The NET-4 provides NFPA Style 4 type communication. This communication is RS-485 operating at 19.2K Baud. The communication is fully digital.



**NET-4**

**NET-7 Style 7 Network Interface Card**

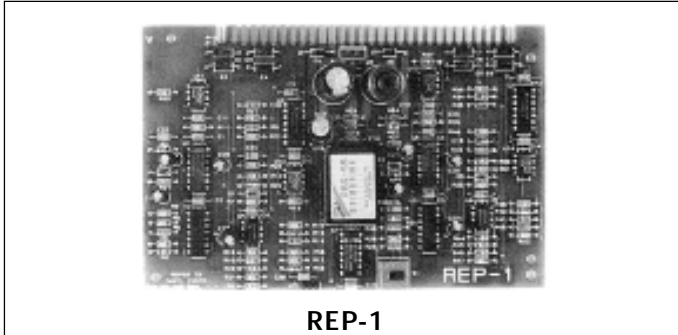
The NET-7 is a microprocessor controlled MXL network interface module which allows the wiring of the MXL RS-485 network in an NFPA Style 7 configuration. The NET-7 plugs into a half slot of the MOM-2/4 card cage at the MXL command center (MMB-2) and the PSR-1 or MOM-4 slot at the MXL remote units (MXLR, MXLRV). The NET-7 provides two independent and fully supervised communication paths allowing system operation through an open as well as short circuit. It also isolates the power supplies at each remote unit providing the ability to localize ground fault conditions. The communication operates at 19.2K Baud and is digital.



**NET-7**

### REP-1 Network Repeater Module

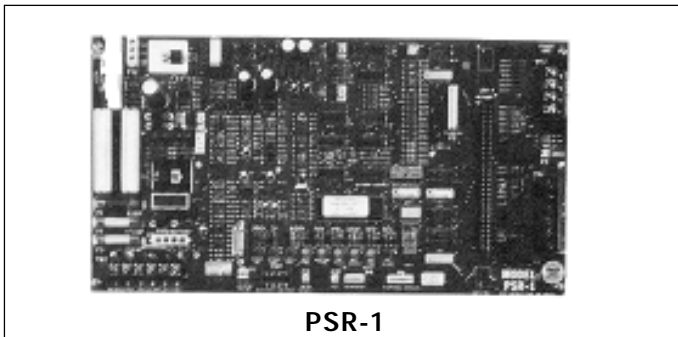
The REP-1 provides the ability to configure the MXL's local or global networks in a star or daisy chain configuration. The REP-1 provides two Style 4 or one Style 7 RS-485 network circuits. Through the use of the REP-1, the MXL's local network (MXL-MXLR) can be expanded up to 64 nodes.



REP-1

### PSR-1 Remote Power Supply

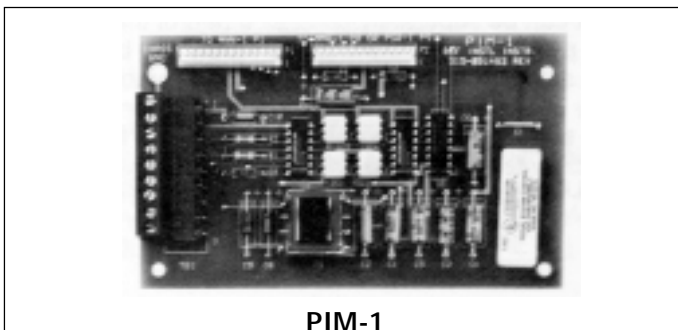
The PSR-1 is a microprocessor controlled remote power supply and battery charger for use with the Fire Safety MXL. It operates in conjunction with either an MPS-6 or MPS-12 to provide 6 or 12 Amps of power for use with various MXL modules. When used with a NET-4 or NET-7 plug-in communication module, the PSR-1 becomes a part of the MXL's internal network. It acts as an interface between remote option modules and the MXL.



PSR-1

### PIM-1 Peripheral Interface Driver

The PIM-1 is an MXL option module which provides a bidirectional isolated RS-232 port for connection to peripheral devices such as printers, CRT's, VDT's, Color Graphics, Alpha-Numeric Pagers and Remote Diagnostics Hardware. The PIM-1 mounts in the MXL Enclosure. It connects to the MMB-2 and provides a screw terminal block for connection of RS-232. A number of supervised and non-supervised formats are available.

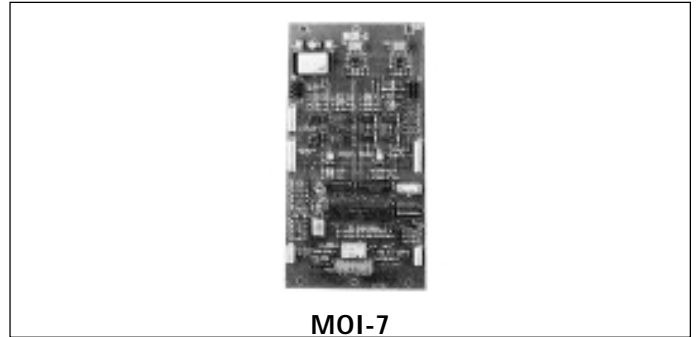


PIM-1

### MOI-7 Output/Input Module

The MOI-7 is an MXL RS-485 Network module which provides a fully programmable serial interface to the MOD-16 output drivers and MID-16 input drivers. When used with the MOD-16's, it provides a serial annunciator output or relay driver. When used with MID-16, it provides programmable inputs.

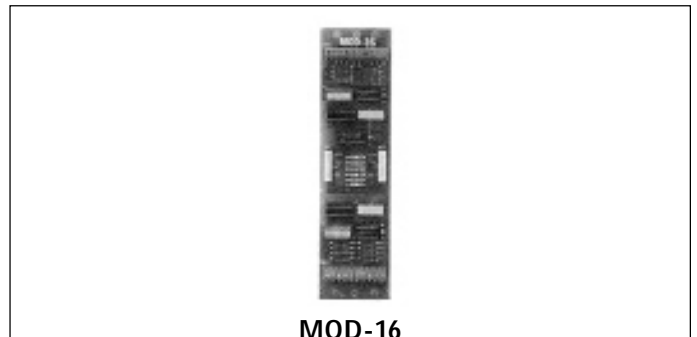
Each MOI-7 can operate up to eight MOD-16's and eight MID-16's simultaneously. Each MOD-16 output and MID-16 input is independently programmable via the MXL custom software.



MOI-7

### MOD-16 Output Driver

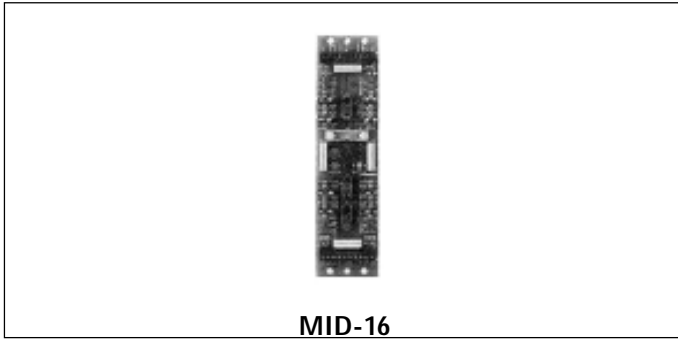
The MOD-16 is an output driver module used in conjunction with the MOI-7 as a part of the Fire Safety MXL System. Up to eight (8) MOD-16s can be connected to an MOI-7 interface module. Each MOD-16 provides 16 open collector current sinking outputs rated at 24 VDC, 50mA. MOD-16 outputs are programmable through the MXL custom software.



MOD-16

### MID-16 Programmable Input Driver

The MID-16 is an input module used in conjunction with the MOI-7 as a part of the Fire Safety MXL System. Up to eight MID-16s can be connected to a single MOI-7 along with eight MOD-16 output driver modules. Each MID-16 provides a non-supervised input which can monitor normally open contact devices. Each individual MID-16 input can be separately used as a part of the MXL custom programming logic. These inputs can be individually set for either Alarm, Supervisory, Trouble, Security or Status usage. They can also be configured to provide supervision for lamps driven by MOD-16 outputs. Screw terminals and connectors are provided on the MID-16 modules for interface to monitored devices.

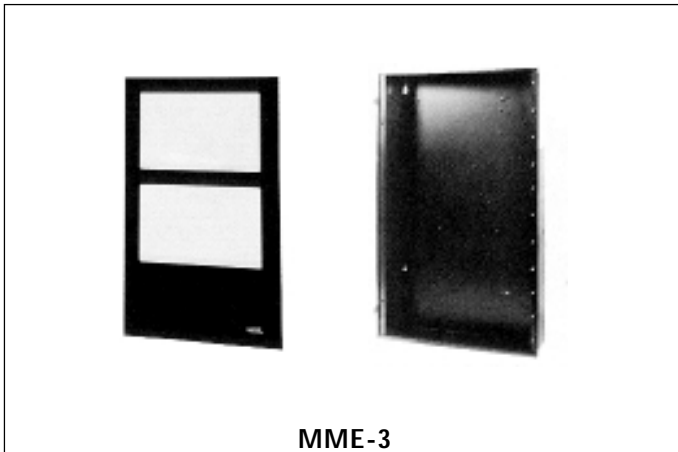


**MID-16**

### **MME-3 MXL/V Standard Size Enclosure**

The MME-3 enclosure set consists of a sheetmetal backbox and door with keylock. The MME-3 can be used for either the MXL System, MXLV Voice Command Console, MXLR Transponder, MXLRV Voice Transponder or Amplifier Equipment (using the MSR-1 Rail Kit). To mount MXL/MXLV modules in the MME-3, the MBR-MP removable module mounting plate is required. Using the MBR-MP mounting plate (1) MMB or (1) PSR-1 and up to 3 expansion cardcages (MOM or OMM) can be mounted in the MME-3 enclosure. When used to mount MXL amplifiers (EL-410), the MBR-MP is not required, instead up to (3) EL-410 amplifiers may be installed in the MME-3 by using (3) MSR-1 Rail Kits. When amplifiers are mounted in any enclosure always install MDG-1 grills in the door for proper ventilation.

MME-3 is designed for surface or semi-flush mounting and includes various knockouts for wire and conduit entry. The door in the MME-3 set has two cutouts for either clear lenses, blank plates or grills depending on the application, and contains a key lock.



**MME-3**

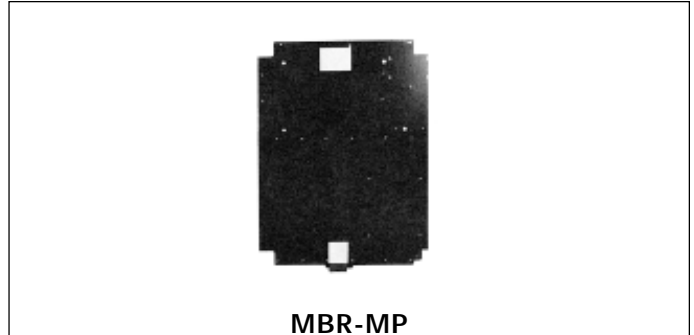
### **MBR-MP MME-3 and MLE-6 MXL Module Mounting Plate**

The MBR-MP MXL/V Module Mounting Plate is required for use in both MME-3 and MLE-6 enclosures to mount all MXL and MXLV equipment. MBR-MP is not necessary if the MME-3 and MLE-6 enclosures are to be used only for mounting of amplifiers (EL-410).

The MBR-MP is a removable MXL/V module mounting plate that allows the enclosure MME-3 or MLE-6 to be shipped to the job site for installation of wiring and conduit, while the system hardware (electronics) is mounted to the studs on the MBR-MP, pre-wired, programmed and tested prior to delivery and installation at the job site. This allows for quicker, more efficient system start ups with less chance of the sensitive electronics being damaged while field wiring and conduit are connected to the system enclosure.

MBR-MP mounting plate bolts to either the MME-3 or MLE-6 enclosures for easy installation on the job site. The MBR-MP also has handles to allow easy transport and mounting. The MBR-MP contains mounting studs for (1) MMB or PSR-1, (1) PIM-1, (1) TBM-2, and up to (3) MOM or OMM cardcages or 2 cardcages and (1) TSP-40 Printer (same mounting studs as the MBR-2 enclosures).

The MBR-MP is ordered and shipped separately from the MME-3 and MLE-6 enclosures.



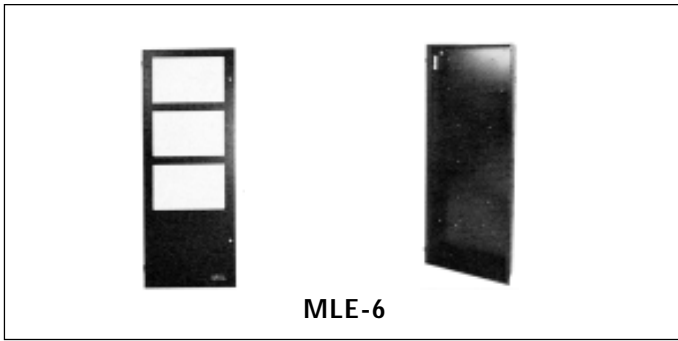
**MBR-MP**

### **MLE-6 MXL/V Large Size Enclosure**

The MLE-6 enclosure set consists of a sheetmetal backbox and door with two key locks. The MLE-6 can be used for either the MXL system, MXLV Voice Command Console, MXLR Transponder, MXLRV Voice Transponder or Amplifier Equipment (using the MSR-1 Rail Kit). To mount MXL/V modules in the MLE-6, the MBR-MP removable module mounting plate is required with the MBR-3MP optionally available for use. Using the MBR-MP mounting plate (1) MMB or PSR-1 and up to (3) expansion cardcages (MOM or OMM) can be mounted in the MLE-6. If additional cardcages are required, the MBR-3MP optional cardcage mounting plate can also be installed in the MLE-6 below the MBR-MP. The MBR-3MP allows mounting of an additional (3) MOM or OMM module expansion cardcages.

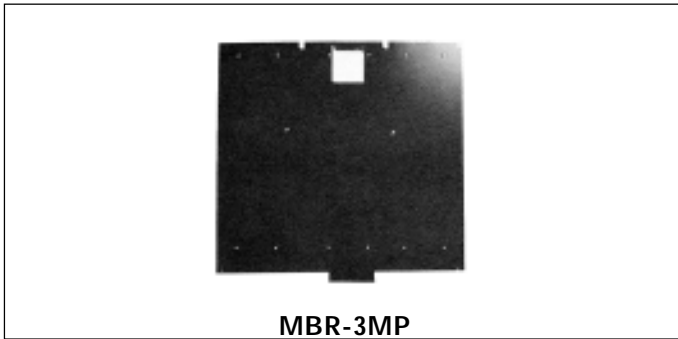
Various combinations of hardware can be installed in the MLE-6. If only amplifiers are to be installed in the MLE-6, no MBR-MP or MBR-3MP plates are required. Instead up to (5) EL-410 amplifiers can be installed by using (5) MSR-1 rail kits. The MLE-6 can also be used to mount up to (3) MXL cardcages and (2) amplifiers. This configuration would be typical of a remote voice transponder cabinet. In this configuration (1) MBR-MP would be used in the upper half of the MLE-6 to mount the MXL modules, while the lower half would use (2) MSR-1 rail kits to mount up to (2) EL-410 amplifiers.

The MLE-6 is designed for surface or semi-flush mounting and includes various knockouts for wire and conduit entry. The door supplied with the MLE-6 set has (3) cutouts for either clear lenses, blank plates or grills, depending on the application. The door also contains (2) key locks — keyed the same. Various combinations of dead front mounting plates are possible with the MLE-6 enclosure. A typical MXLV installation would have (1) MKB-2 at the top, and (2) MHD-3 dead front plates in the middle (for (14) VSM/VLM/VFM modules per plate) and (1) or (2) MHD-2 lower dead front plates.



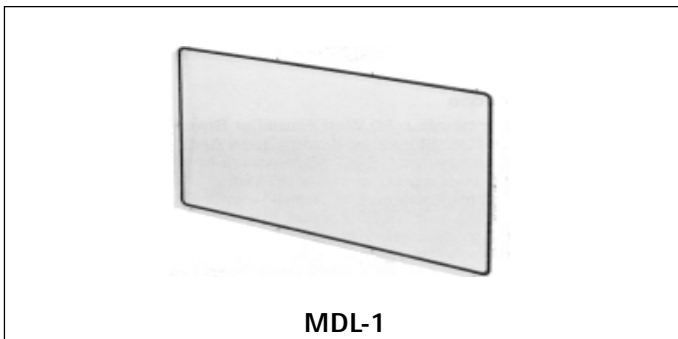
**MBR-3MP MLE-6 Optional Cardcage Mounting Plate**

The MBR-3MP is an optional MXL/MXLV cardcage mounting plate for use exclusively in the MLE-6 enclosure. When installed in the MLE-6 backbox, the MBR-3MP adds the option of mounting up to an additional (3) MOM or OMM expansion cardcages.



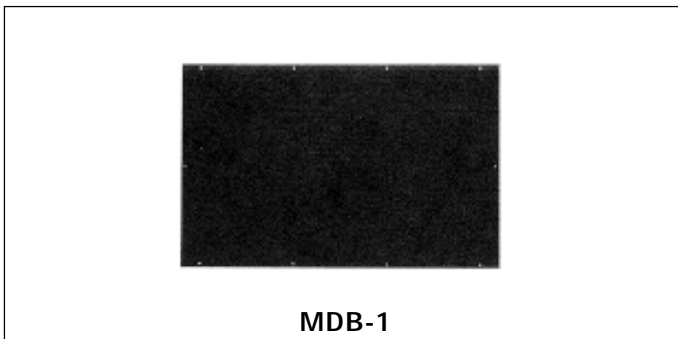
**MDL-1 Clear Lens**

The MDL-1 is a clear Plexiglas® lens which fits in either one of the two openings in the MME-3 enclosure door or in one of the three openings in the MLE-6 enclosure door. One lens is included in the MDL-1 package.



**MDB-1 Sheet Metal Blank Plate**

The MDB-1 is a sheet metal blank plate which fits in either one of the two openings in the MME-3 enclosure door or in one of the three openings in the MLE-6 enclosure door. One blank plate is in the MDB-1 package.



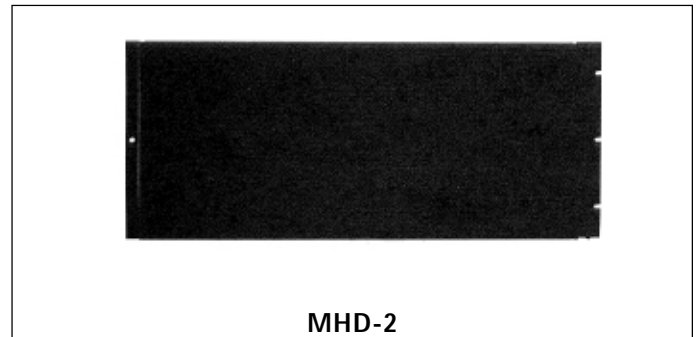
**MHD-1 Upper or Middle Dead Front Panel**

The MHD-1 is a hinged sheet metal panel which attaches to either the MME-3 or the MLE-6 enclosure backbox. It fits in either the upper or the middle section of the MME-3 backbox or the upper or either of the two middle sections of the MLE-6 backbox. It has an opening with a cover plate for the TSP-40 printer when used and attaches to the backboxes with screw fasteners. When in place it covers and protects modules and wiring, providing dead front construction in that area.



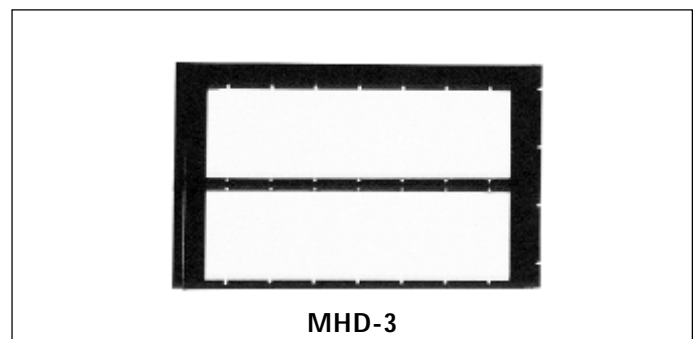
**MHD-2 Lower Dead Front Panel**

The MHD-2 is a hinged sheet metal panel which attaches to either the MME-3 or the MLE-6 backboxes. It mounts in the lower section on the MME-3 and on the lower two sections of the MLE-6 backbox. It has no openings and attaches to the enclosures with screw fasteners. When in place, it covers and protects modules and wiring, providing dead front construction in that area.



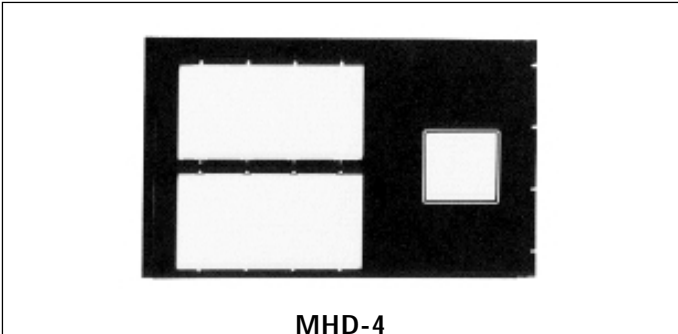
**MHD-3 Middle Dead Front Plate for Mounting Switch/LED/Fan Control Modules**

The MHD-3 is a hinged sheet metal panel that attaches to the MME-3 or MLE-6 backboxes. It fits in either the middle or the upper sections of these enclosures. It has openings for two rows of VSM-1 Switch Modules, VLM-1 LED Annunciator Modules, VFM-1 Fan Control Modules or VSB-1 Blank Plates. Each row can mount up to (7) modules for a total of (14) modules per MHD-3. The MHD-3 attaches to the backboxes with screw fasteners. It is hinged for easy access to the rear of the modules and inside of the enclosure.



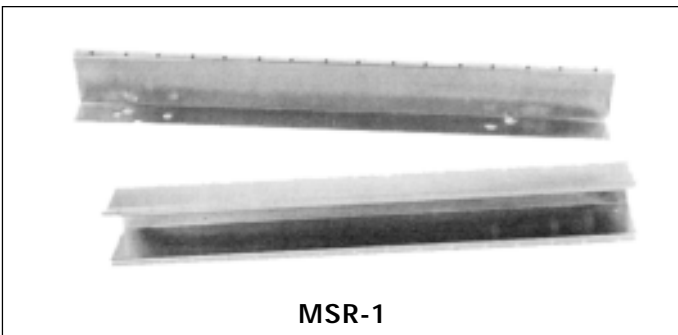
**MHD-4 Middle Dead Front Plate for the Switch/LED/ Fan control Modules with Printer Cutout**

The MHD-4 is a hinged sheet metal panel that attaches to the MME-3 or the MLE-6 backboxes. It fits in the middle section of both enclosures. It has two rows for mounting of VSM-1 Switch Modules, VLM-1 LED Annunciator Modules, VFM-1 Fan Control Modules or VSB-1 Blank Modules. Each row has space to mount (4) modules, for a total of (8) modules per MHD-4. The MHD-4 also has a cutout to display the TSP-40 Internal Thermal Strip Printer. The MHD-4 mounts to the backboxes with screw fasteners. It is hinged for easy access to the rear of the modules and inside of the enclosure. When in place, it covers and protects modules and wiring, providing dead front construction in that area.



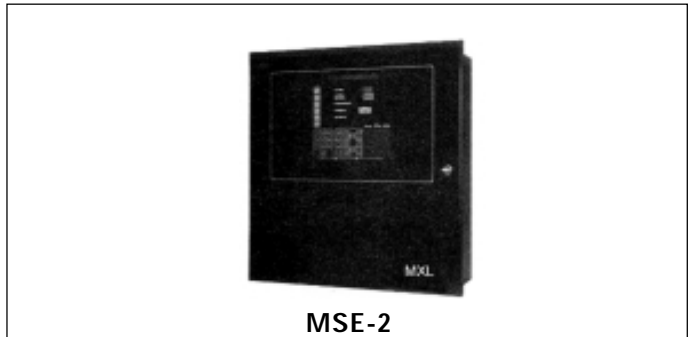
**MSR-1 Rail Kit**

The MSR-1 is a System 3 type rail kit which fits into either the MME-3 or the MLE-6 enclosures. The MSR-1 comes with a U-bracket and a Z-bracket. It allows modules such as the EL-410 amplifier, PS-35 Power Supply, BC-35 Battery Charger, MOI-7 I/O Interface, MID-16 Input Driver, MOD-16 Output Driver, PS-5A Power Supply, SYS3-MPFO for mounting the D2300CP Fiber Optic Interface modules or the CCU Pager interface, or any other System 3 type module required to be mounted in the MME-3 or the MLE-6 enclosures. When used in the MME-3 enclosure (3) MSR-1 Rail Kits can be installed to mount up to three rows for up to (3) EL-410 amplifiers. When used in the MLE-6, up to (5) MSR-1 Rail Kit rows can be installed to allow mounting up to (5) EL-410 amplifiers. When the MLE-6 enclosure is used with the MBR-MP mounting plate to install MXL or MXLV equipment, up to (2) MSR-1 Rail Kit rows can also be installed in the MLE-6 for mounting of either (2) EL-410 amplifiers or some complement of System 3 type mount modules.



**MSE-2 MXL Small Enclosure**

The MSE-2 is a small MXL enclosure capable of housing an MMB-2 or PSR-1 and MPS-6 or MPS-12. When expansion is required the MSE-2 provides for mounting of either one (1) MOM-2 or OMM-2. MSE-2 is part of the MXL-SS and MXLV-SS packages.



**MXL-VDT Interactive Video Display Terminal**

The MXL-VDT is a 14" amber monitor with detachable keyboard. It provides an interactive terminal for secondary display of MXL information, and operation of MXL functions such as Acknowledge, Silence and Reset, as well as arming and disarming devices. It also provides a means for generating system reports such as listing smoke detector sensitivity settings and voltages, battery and power supply voltages and current, and displaying the event log. A printer may be connected to the MXL-VDT.



**TSP-40 Thermal Strip Printer**

The TSP-40 is a thermal strip printer designed for use with the Fire Safety MXL system. It mounts in the MXL enclosure and its printout is visible through a window in the locked enclosure door. Printouts are automatically spooled on a take-up reel for easy record storage.





### RCC-1 Remote Command Console

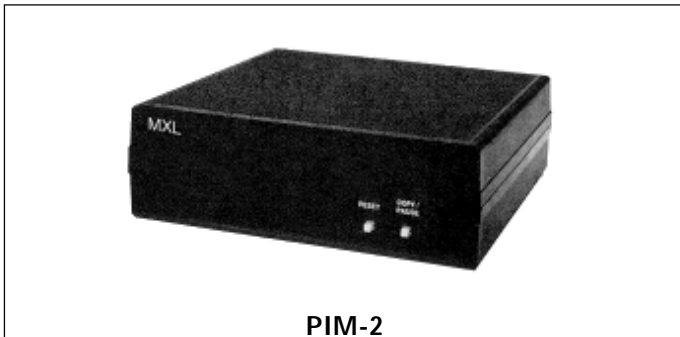
The RCC-1 is a remotely located MXL annunciator display module. The RCC-1 contains an 80 character LCD display and control keypad (MKB) and a PS-5N7 network interface. RCC-1s can be located anywhere that control or annunciation is required. RCC-1 can be programmed for display only or can provide display and system control. If a PIM-1 is added to the RCC-1, remote printers, VDT, or graphics computers can be located throughout a facility.



RCC-1

### PIM-2 Parallel Printer Interface

The PIM-2 is an MXL or CXL parallel printer interface module. PIM-2 connects to PIM-1 to allow MXL connection and supervision of any EDP UL listed printer.



PIM-2

### PAL-1 UL Listed Parallel Printer

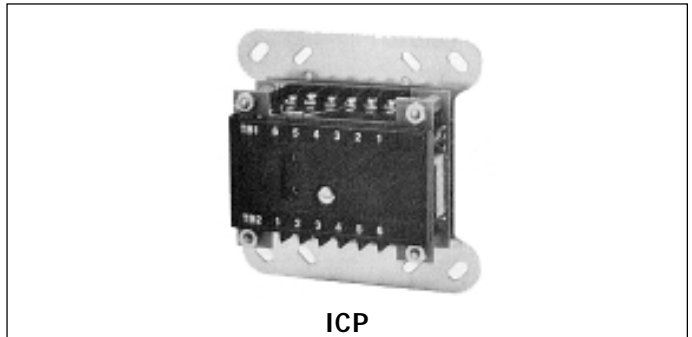
The PAL-1 is a UL listed supervised parallel system printer for MXL or CXL. The PAL-1 connects to the PIM-2 and PIM-1 to provide MXL with a UL listed parallel printer that is supervised.



PAL-1

### ICP-B6 Intelligent Control Point

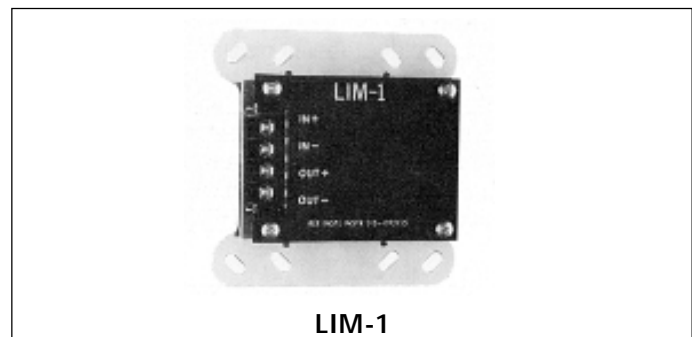
The ICP is a field mounted output module capable of being programmed to be either a remote bell or horn, speaker or telephone zone. The ICP communicates with the MXL via the ALD loop.



ICP

### LIM-1 Line Isolator Module

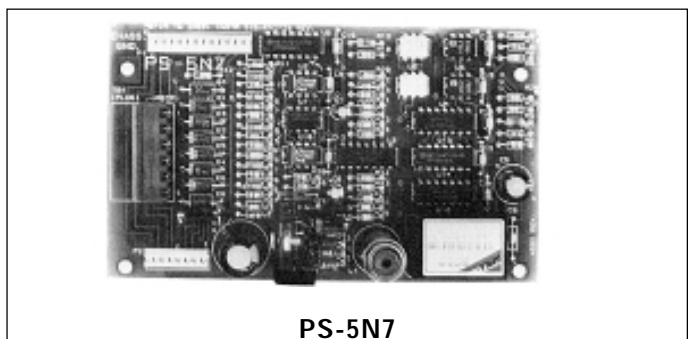
The LIM-1 is a short circuit isolator module for use on the MXLs analog loops. The LIM-1 is capable of providing Style 4 or Style 6 wiring of ALD loops. Multiple short circuit isolators can be used on a single ALD loop to prevent loss of protection in the event of a short circuit.



LIM-1

### PS-5N7 5 Volt Power Supply/Network Interface

The PS-5N7 is a 5V power supply and MXL local network interface module. The PS-5N7 is an integral part of the RCC-1. The PS-5N7 can be used to provide a Style 4 or Style 7 network interface for either a remote transponder for MXLV with either TBM-2, ACM-1 and VSM-1/VLM-1/VFM-1 or to drive OMM-1 and associated MXLV cards.



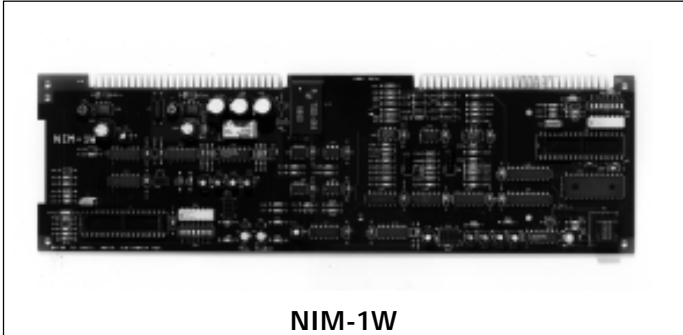
PS-5N7

### PS-5A 5 Volt Power Supply

The PS-5A provides 5 Volts for powering the MOI-7. It obtains its power from the 24-volt supply in the MXL system. Both the MOI-7 and the PS-5A mount on system 3 rails. They can also be mounted external to the MXL control. They typically drive remote graphic annunciators or monitor foreign systems and devices.

**NIM-1W Network Interface Module**

The NIM-1W allows the interconnection or networking of up to 63 MXL systems. The NIM-1W provides an RS-485 communication path in either Style 4 or Style 7 wiring configurations. The NIM-1W allows MXLs to have interpanel logic and communicate in a peer to peer fashion. The NIM-1W can be programmed via CSGM logic as a Foreign System Interface to communicate with external building management systems.



**NIM-1W**

**FireFinder NCC-G — Network Color Graphics**

FireFinder is a PC based color graphics command center designed for use with the LifeLINK network and provides full control and annunciation for a LifeLINK network of up to 63 MXL-IQ or MXL systems. The NCC-G is used to monitor and control alarms, troubles, security, supervisory and all system events from one of many MXL series systems. The NCC-G maintains an extensive history log of all system events and has extensive report generation capabilities. User programmable function buttons allow site specific control functions. Multiple NCC-Gs may be connected to a LifeLINK network. PC ordered separately. The model NCC-GL is a color graphics command center for a single, stand-alone MXL system. It has all of the features of the NCC-G.



**FireFinder NCC-G**

**CCU/M Alphanumeric Pager Interface**

The CCU/M is an ancillary module that connects to the PIM-1 to transmit MXL status information in text message format to an alphanumeric pocket pager. The CCU/M can be connected to an existing phone line and can dial out to a pager using its onboard modem to transmit information via a paging service. The CCU/M can also connect directly to an existing on-site paging system. Through programming the CCU/M can send different types of events to different pagers. Up to 8 different messages can be sent to pagers directly from the CCU/M. Alarms, Troubles, Supervisory, Security, Arm/Disarm, Status Points, Audible Status, and Reset can be directed to all or only certain alphanumeric pocket pagers.

**RDM-MXL, RDM-PC**

The RDM-MXL in combination with the RDM-PC provides the ability to call up an MXL system to check on the system status. The RDM-PC connects a remote computer to the MXL equipped with the RDM-MXL. The RDM-PC initiates a call to the MXL's RDM-MXL module. The RDM-MXL answers the call. The RDM-PC identifies itself with the login name. As a built-in security measure, when the login name is recognized by the RDM-MXL, it then hangs up and initiates a call back to verify the login and password. Once the login and password is verified, the operator is on-line with the MXL. The operator can list system status, alarms, troubles, supervisory, and/or security events!



**CCU/M**

## MMB-2

### Electrical Specifications for Analog Loop Devices (TB2, 1-4 and TB3, 1-4)

- Electrical Ratings:
  - Supervisory: 24VDC peak, 105mA max.
  - Alarm: 24VDC peak, 105mA max. (60 devices in alarm)
- All wiring must be in accordance with Article 760 of NEC or local building codes.
- Only Siemens Building Technologies, Inc. Fire Safety devices may be used. (See Table 1)  
A maximum of 60 devices in any combination may be connected to a single analog loop.
- No end of line device required.
- Both circuits are power limited to NFPA 70/NEC. Each detector or group of detectors, requires a two wire circuit of minimum 18 AWG thermoplastic fixture wire enclosed in a conduit or minimum 18 AWG limited energy shielded cable without conduit, if permitted by local codes.
- Total circuit resistance must not exceed 100 ohms. Maximum capacitance:
  - 0.4 $\mu$ F between + loop and - loop
  - 0.8 $\mu$ F between + loop and chassis
  - 0.8 $\mu$ F between - loop and chassis
- T-tapping is not allowed on Class A (Style 6) loops

### MMB-2 CZM-1 Power

- AUX power is available on TB5 terminals 9-12
- All wiring must be in accordance with Article 760 of NEC or local building codes.
- AUX power is power limited to NFPA 70/NEC 760.
- Electrical Ratings: 18-31 VDC, 1A max.

### MMB-2 Notification Appliance Circuits (TB5, 1-4 and TB5, 5-8)

- These notification appliance circuits are for alarm notification appliances only (NFPA 72 Local). For Municipal tie (NFPA 72, Chapter 4 ) or Leased Line (NFPA 72, Chapter 4), use model CSM-4.
- All wiring must be in accordance with Article 760 of NEC or local building codes.
- Both notification appliance circuits are power limited to NFPA 70/NEC 760.
- Electrical Ratings:
  - Supervisory 18-31 VDC, 12mA max
  - Alarm 18-31 VDC, 1.5A max.
- End of Line Device: EOL 2.2K, 1/2W (P/N 140-820380)
- Line Resistance: Not to exceed 3 ohms max

For compatible notification appliances see 315-096363

Model Number	Description	Part Number
CZM-1	Conventional Zone Module	315-090725
ILI-1/1H/1A/1AH	Intelligent Ion Detectors	315-092724
ILP-1/IPLT-1	Intelligent Photo Detectors	315-092594
ILT-1	Intelligent Heat Detectors	315-093336
ILI-1B/1BH	Intelligent Ion High Vel.	315-093234
ILP-2	FirePrint™ Application Specific Detection	315-095028
MSI-10B/20B	Intelligent Manual Station	315-093329
MS-MI	Intelligent Metal Manual Station	315-092169
TRI-B6/B6D/B6R	Intelligent Monitor Module (single/dual and with array)	315-093315
TRI-B6M	Intelligent Mini-Monitoring Module	315-094547
ICP	Intelligent Control Point	315-092471
LIM-1	Line Isolator Module	315-092135
FP-11	Intelligent Fireprint™ Detector	315-095921
TRI-S/D/R	Intelligent Monitor Module	315-096242

For further details refer to MXL Manual P/N 315-092036.



# 31 00 00 EARTHWORK AND GRADING

## PART 1 - GENERAL

### 1.1 SUMMARY

- A. This section describes general requirements, products, and methods of execution relating to on-site earthwork. Any work within the public right-of-way shall be constructed to the standards of the City of Redwood City, and the State of California Department of Transportation. Earthwork includes, but is not limited to, the following:
  - 1. Grading.
  - 2. Material.
  - 3. Excavation.
  - 4. Filling and backfilling.
  - 5. Soil Sterilant.
  - 6. Termiticide.
  
- B. Provide labor, material and equipment and services necessary to complete the excavations, recompaction and finish grading as specified and indicated on Plans.
  - 1. Obtain permit from local authorities.
  - 2. Provide surveying for grading operations.
  - 3. Provide shoring design.
  - 4. Provide dewatering operations.
  - 5. Provide Site grading, cut, fill and finish.
  - 6. Provide excavation and backfill for filling construction, including trenches within building lines.
  - 7. Preparation for subgrade for building slabs, walks, pavements, and landscaping.
  - 8. Provide distribution of stockpiled topsoil.
  - 9. Provide sub-base course for walks and pavements.
  - 10. Provide sand and gravel for capillary break/moisture barrier under building slabs.
  - 11. Provide sub-surface drainage backfill for walls and trenches.
  - 12. Provide Engineered fills for building slabs and foundations.
  
- C. The work includes removal and legal disposal off the site of debris, rubbish and other materials resulting from clearing and grubbing operations.
  
- D. Work specified in Related Sections:
  - 1. Section 31 10 00 – SITE PREPARATION.
  - 2. Section 31 23 33– TRENCHING, BACKFILLING, & COMPACTING.

### 1.2 DEFINITIONS

- A. Engineered Fill:
  - 1. Soil or soil-rock material approved by Project Manager and/or Geotechnical Engineer and transported to the site by the Contractor in order to raise grades or to backfill excavations.
  - 2. The District's Testing Agency will make sufficient tests and/or observations for the purpose of issuing a written statement that specification requirement have been met.
  
- B. On-site Material: Soil or earth material obtained from required on-site excavation.
  
- C. Excavation: Consists of the removal of material encountered to subgrade elevations and the re-use or disposal of materials removed.
  
- D. Subgrade: The uppermost surface of an excavation or the top surface of a fill or backfill

- immediately below sub-base, drainage fill, or topsoil materials.
- E. Borrow: Soil material obtained off-site when sufficient approved soil material is not available from excavations.
  - F. Base Course: The layer placed between the sub-base and surface pavement in a paving system.
  - G. Relative Compaction: In-place dry density of soil expressed as percentage of maximum dry density of same materials, as determined by laboratory test procedure American Society for Testing and Materials (ASTM) D1557 latest version.

### **1.3 SYSTEM DESCRIPTION**

- A. Requirements:
  - 1. Grades and elevations are to be established with reference to bench marks referenced on Plans.
  - 2. Maintain Engineering markers such as monuments, bench marks and location stakes. If disturbed or destroyed, replace.
- B. Criteria:
  - 1. The character of the material to be excavated or used for subgrade is not necessarily as indicated.
  - 2. Ground water elevations indicated are those existing at the time subsurface investigations were made and do not necessarily represent ground water elevation at the time of construction.
  - 3. Blasting will not be permitted.
  - 4. Remove material in an approved manner.
- C. Shoring Design: Where shoring is required by State Law or determined by the Contractor to be necessary, provide proposed excavation shoring method for review prior to commencement of excavation requiring shoring. Include the following information:
  - 1. Basic design assumptions.
  - 2. Design Calculations.
  - 3. Describe materials or shoring system to be used.
  - 4. Indicate whether or not any components will remain after filling or backfilling.
  - 5. The shop plans for the proposed shoring system.
  - 6. Coordinate with the Construction Documents and identify any proposed modifications or deviations.
  - 7. Certification of the above by a registered professional civil or structural Project Manager licensed by the State of California.
- D. Dewatering Plan: Based upon site surface and subsurface conditions, including available geotechnical and hydrological data, provide a system to perform the following:
  - 1. Lower the ground water level two feet below the bottom of excavation at the deepest grade.
  - 2. Relieve the hydrostatic pressure below the subgrade to prevent uplift.
  - 3. Prevent surface drainage from accumulating within work area.
  - 4. Legally discharge and dispose of excess water.
  - 5. Submit description of basic components of proposed dewatering system and its planned method of operation.
- E. Safety:
  - 1. The Canada College campus has a history of serpentine rock. The Contractor shall take all necessary precautions to eliminate the exposure of workers, students, staff and the public to asbestos fibers, including but not limited to: dust control measures and measures included in Section 93106 and Section 93105 of California Code of Regulations, Title 17.

## 1.4 SUBMITTALS

- A. Comply with provisions of Section SUBMITTAL PROCEDURES.
- B. Product Data: Manufacturer's literature and data, including, where applicable, capacity, labels, or other markings on equipment made to the specified standards for materials, for the following:
  - 1. Imported materials.
  - 2. Class II aggregate base (CDT Section 26).
  - 3. Storm Water Pollution Prevention / Erosion Control Plans.
  - 4. Permit/Notice of Intent (N.O.I.), for discharge of storm run-off from the construction site.
  - 5. Soil Sterilant.
  - 6. Termiticide.
- C. Test Reports: Submit following reports (not older than six (6) months from the import date) for import material directly to Project Manager from the Contractor's testing services:
  - 1. Test reports on borrow material.
  - 2. Density test reports.
  - 3. One optimum moisture-maximum density curve for each type of soil encountered.
  - 4. Report of actual unconfined compressive strength and/or results of bearing test of each strata tested.
  - 5. Available geotechnical and/or environmental reports
- D. Shoring Design: Submit 4 copies of shoring design and shop plans; none will be returned unless a concern is observed.
- E. Submit description of dewatering methods proposed for use.
- F. Submit description of vibratory compactors proposed for use when requesting placement of backfill and fill materials in layers greater than 6 inches thick.
- G. Samples:
  - 1. 20-lb. Samples, sealed in air-tight containers, of each proposed fill and backfill soil material from on-site or borrow sources.
  - 2. 12-by-12 inch sample of filter fabric.

## 1.5 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies:
  - 1. Comply with State of California Business and Transportation Agency, Department of Transportation (Caltrans) "Standard Specifications."
  - 2. Comply with State of California Code of Regulations (CCR).
  - 3. Comply with State of California Construction Safety Orders, Latest Edition (CAL/OSHA).
- B. Soil Testing:
  - 1. District will engage a geotechnical testing agency, to include testing soil materials proposed for use in the work and for quality control testing during excavation and fill operations.
  - 2. Test results will be distributed in compliance with Section TESTING AND INSPECTION.
- C. Codes and Standards:
  - 1. Perform excavation work in compliance with applicable requirements of authorities having jurisdiction.
  - 2. Storm Water Pollution Prevention and Monitoring Plan to be prepared by others.
  - 3. Statewide General Permit to Discharge Storm Water associated with construction activity.
- D. Comply with the latest editions of the following Standards and Regulations as deem necessary:
  - 1. American Society for Testing and Materials (ASTM):

- a. C33: Concrete Aggregates.
  - b. C125: Standard Terminology Relating to Concrete and Concrete Aggregates.
  - c. C136: Sieve Analysis of Fine and Coarse Aggregates.
  - d. C566: Total Evaporable Moisture Content of Aggregate by Drying.
  - e. D421: Dry Preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Constants.
  - f. D422: Particle Size Analysis of Soil.
  - g. D854: Specific Gravity of Soils.
  - h. D1556: Density of Soil by the Sand Cone Method.
  - i. D1557: Laboratory Compaction Characteristics of Soil Using Modified Effort
  - j. D2216: Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures.
  - k. D2487: Classification of Soils for Engineering Purposes.
  - l. D2922: Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
  - m. D2937: Density of Soil in Place by Drive Cylinder Method.
  - n. D3017: Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
  - o. D4318: Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
  2. California Code of Regulations, Title 24, Part 2 - Basic Building Regulations, Chapter 24 - Excavations, Foundations, and Retaining Walls.
  3. California Department of Transportation (CDT) Standard Specifications:
    - a. Section 17:
    - b. Section 18:
    - c. Section 19: Earthwork.
  4. CAL/OSHA, Title 8.
  5. Other authorities having jurisdiction
- E. Geotechnical Engineering Services:
1. Geotechnical Engineer will observe grading observations during preparation offsite, excavation, and compaction of fill materials.
  2. Make visits to site to familiarize himself generally with progress and quality of work.
  3. Make field observations and tests to enable him to form opinions regarding adequacy of site preparation, acceptability of fill materials and extent to which earthwork construction and relative compaction comply with specifications requirements.
  4. Examine conditions exposed in foundation excavations.
- F. Site Information:
1. Soil borings and other exploratory operations may be made by Contractor at no cost to District. Submit proposed boring locations for review prior to performing the work.

## **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Protect materials of this section before, during and after installation; objects designated to be retained; and the installed work of other trades.
- B. In the event of damage to any of these items, immediately make repairs or replacements necessary to the acceptance of the Project Manager and at no additional cost to the District.
- C. Comply with provisions of Section 01500 - TEMPORARY FACILITIES AND CONTROLS where necessary to control dust and noise on and near the work caused by operations during performance of the Work.

## **1.7 PROJECT CONDITIONS**

- A. Environmental Requirements:



1. When unfavorable weather conditions necessitate interrupting filling and grading operations, prepare areas by compaction of surface and grading to avoid collection of water.
  2. Provide adequate temporary drainage to prevent erosion.
  3. After interruption, reestablish compaction specified in last layer before resuming work.
  4. Protect existing storm drainage system from silt and debris resulting from construction activities. If contamination occurs, remove contamination at no cost to District.
  5. Protect existing streams, ditches and storm drain inlets from water-borne soil by means of straw bale dikes, filter fiber dams, or other methods as approved by the Project Manager.
- B. Barricade open excavations and post with warning lights.
1. Comply with requirements of Section TEMPORARY FACILITIES AND CONTROLS.
  2. Operate warning lights as recommended by authorities having jurisdiction.
  3. Protect structures, utilities, sidewalks, pavements, and other facilities immediately adjacent to excavations, from damages caused by settlement, lateral movement, undermining, washout and other hazards.
- C. Protection of Subgrade: Do not allow equipment to pump or rut subgrade, stripped areas, footing excavations, or other areas prepared for project.
- D. At Contractor's option, a working pad of granular material may be laid to protect footing and floor subgrade soils from disruption by traffic during wet conditions.
- E. Transport all excess soils materials by legally approved methods to disposal areas. All excess soils are to be disposed of offsite by the contractor.
1. Coordinate with the Project Manager.
  2. Sufficient topsoil and fill material shall be retained from the site to complete project requirements.
  3. Any additional topsoil and fill requirements shall be the responsibility of the Contractor.
- F. Use of explosives will not be permitted.
- G. Dust Control Requirements: At all times during earthwork operations and until final completion and acceptance of the earthwork, the Contractor shall prevent the formation of an airborne dust and dirt nuisance from interfering with the surrounding normal operations. The Contractor shall effectively stabilize the site of work in such a manner that it will confine dust particles to the immediate surface of the work and to obtain a minimum of 40 percent emissions reduction by applying a dust palliative. The dust palliative shall be non-petroleum based. Water alone is not considered to be a dust palliative. The dust palliative shall be applied at the rate and method in conformance with Section 18, "Dust Palliative," of the CDT Standard Specifications and as recommended and/or specified by the manufacturer. Contractor shall assume liability for all claims related to dust and dirt nuisances.

## **1.8 Existing Utilities**

- A. The Contractor shall contact local utility agencies prior to construction and arrange for the shut-off of all utilities serving the buildings to be demolished. Coordinate work required to abandon active lines with the Project Manager and the District.
- B. Locate existing underground utilities in the areas of work. If utilities are to remain in place, provide adequate means of protection during excavation operations.
- C. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult utility Project Manager immediately for directions.
  1. Cooperate with the District and public and private utility companies in keeping their respective services and facilities in operation.
  2. Repair damaged utilities to the satisfaction of the utility District.

- D. Do not interrupt existing utilities serving facilities occupied and used by the District or others, except when permitted in writing by Project Manager and then only after acceptable temporary utility services have been provided.

## **1.9 SEQUENCING AND SCHEDULING**

- A. The sequence of operations shall be reviewed by the Project Manager prior to commencement of any work.
- B. Coordinate operations with relocation of existing utilities.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. General:
  - 1. Fill material will be subject to approval of the Geotechnical Engineer.
  - 2. For approval of imported fill material, notify the Project Manager at least 7 days in advance of intention to import material, designated proposed borrow area, and permit the Geotechnical Engineer to sample as necessary from borrow area for purpose of making acceptance tests to prove quality of material.
  - 3. The Geotechnical Engineer's report on acceptability shall be final and binding.
  - 4. During grading operations, soil types other than those analyzed in the geotechnical report for the project, may be encountered.
  - 5. Consult the Geotechnical Engineer to determine the suitability of these soils.
- B. Engineered Fill Material: Soil excavated from site or imported conforming to requirements for fill material.
  - 1. Imported materials should have a plasticity index not greater than 15, as determined by ASTM D4318; and expansion index not exceeding 20, as determined by UBC Specification 29-2; and a particle size not exceeding 3 inches as determined by ASTM D422.
  - 2. Import materials shall be approved by the Project Manager and Geotechnical Engineer prior to importing.
- C. On-Site and/or Native Soils: Friable clay loam surface soil found in a depth of not less than 10 inches. Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones and other objects over 2 inches in diameter, and without weeds, roots and other objectionable material.
  - 1. Use topsoil for top 2 feet of fill against exterior walls, except at paving, sidewalks, and slabs.
  - 2. Topsoil may also be used beyond the area within 5 feet of building, except under paving and sidewalks.
  - 3. Confirm suitability of stockpiled materials.
- D. Sand: Clean, well-graded fine to coarse sand with not more than 2 percent passing the #200 sieve based on wet sieve analysis.
  - 1. Where coarse sand is required, provide sand no finer than No. 40 sieve.
- E. Graded Rock Base:
  - 1. Bedding for utility piping: Washed, uniformly graded mineral aggregate ASTM D448 with percentage composition of dry weight conforming with following limits:
    - a. Passing 1-inch Sieve: 100 percent.
    - b. Passing 3/4-inch Sieve: 90-100 percent.
    - c. Passing No. 4 Sieve: 0-10 percent.
  - 2. Base at Slab-on-Grade: As specified in the geotechnical report for this project.
  - 3. Absorption of water to saturated-surface dry condition shall not exceed 3 percent of oven-dry

weight of a sample.

- F Crushed Rock Backfill Material: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, ASTM D 448, coarse aggregate, Sieve No. 57, with 100 percent passing 1-1/2-inch sieve and not more than 5 percent passing No. 8 sieve.
- G Imported Fill Requirements: Imported fill, where required, shall be non expansive granular soil, free of organic matter and deleterious substances. Imported fill material shall conform to the following requirements:
1. Grading:

<u>U. S. Sieve Size</u>	<u>Percentage Passing Sieve</u>
2 1/2 inch	100
No. 8	25-45
No. 200	0-10
  2. Be thoroughly compactable without excessive voids.
  3. Meet the following plasticity requirements:
    - a. Maximum Plasticity Index of 15, as determined by ASTM D4318.
    - b. Maximum Liquid Limit of 35, as determined by ASTM D4318
- H. Imported Fill for Planting Areas: Imported fill for use in planting areas shall be sandy loam weed free soil. Submit analysis from certified Soil and Plant Lab. Coordinate with Landscape Engineer.
- J. Pea Gravel: 3/8 inch to 1/2 inch washed, uncrushed gravel. Use at drainage pipe and at other approved locations.
- K. Filter Fabric: Provide filter fabrics that meet or exceed the listed minimum physical properties determined according to ASTM D4759 and the referenced standard test method in parentheses.
1. Grab Tensile Strength (ASTM D4632): 100 lb.
  2. Apparent Opening Size (ASTM D4751): #100 U.S. Standard sieve.
  3. Permeability (ASTM D4491): 150 gallons per minute per square foot.
- L. Drainage Pipe:
1. Perforated corrugated plastic drainage tubing meeting ASTM F405, with continuous integral nylon filter screen.
  2. Acceptable Manufacturers and Products: Advanced Drainage Systems "DrainGuard," Hancor "Agri-Flow."
  3. Provide couplings, elbows and other fittings as recommended by pipe manufacturer.
- M. Water: Clean and free from deleterious amounts of acids, alkalis, salts and organic matter.

## 2.2 SOIL STERILANT

- A. Soil Sterilant shall be Treflan E.C. or approved equivalent.

## 2.3 TERMITICIDE

- A. Termiticide shall be Permethrin, Denon, or approved equivalent.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Prior to commencement of earthwork, become thoroughly familiar with site conditions.

- B. In the event discrepancies are found, immediately notify the Project Manager in writing, indicating the nature and extent of differing conditions.
- C. No earthwork shall be performed without physical presence or acceptance of the Geotechnical Engineer.
- D. The Geotechnical Engineer's acceptance is required by these specifications; notify the Project Manager at least 48 hours prior to commencing any phase of earthwork.
  - 1. No phase of work shall proceed until prior phase has been accepted by the Geotechnical Engineer.
  - 2. Work shall not be covered up or continued until acceptance of the Geotechnical Engineer shall give written notice of conformance with the specifications upon completion of grading.
- E. Compacting:
  - 1. Compact by power tamping, rolling or combinations thereof as accepted by the Geotechnical Engineer.
    - a. Where impractical to use rollers in close proximity to walls, stairs, etc., compact by mechanical tamping.
    - b. Scarify and recompact any layer not attaining compaction until required density is obtained.
  - 2. Compaction by flooding, ponding or jetting will not be permitted, unless specifically accepted by the Geotechnical Engineer.
- F. Hazardous Materials
  - 1. If any materials are encountered that may be hazardous (as defined in Section 25117 of the California Health and Safety Code), inform the Project Manager verbally within 24 hours and in writing within 2 business days. Upon discovery, material is to remain undisturbed until investigation by Project Manager is complete. The removal and disposal of hazardous materials, if discovered, is not part of the scope of work of this Division for this project.

### **3.2 SITE PREPARATION**

- A. Protect structures, utilities, sidewalks, pavements, and other facilities which are to remain from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations. Set up tree protection measures prior to commencing grading or demolition operations.
- B. Clearing and Grubbing:
  - 1. Remove from area of designated project earthwork all improvements and obstructions, including designated concrete curbs or slabs, asphaltic concrete, all tree and shrub roots, any buried utility and irrigation lines, and other matter determined by the Geotechnical Engineer to be deleterious.
    - a. In all new planting areas, remove existing base material.
    - b. Use only hand methods for grubbing inside the drip line of trees indicated to be left standing.
  - 2. Retain on the site all trees and shrubs, unless otherwise indicated on the plans as existing trees to be removed.
  - 3. Remove or fill existing basements left from removed structures as appropriate to areas. Compact in accordance with requirements of these specifications.
  - 4. Removed material shall become property of the Contractor and shall be removed from site, unless otherwise indicated on the plans or specified herein.
  - 5. Holes resulting from removal of underground obstructions that extend below finish grades shall be cleared and backfilled with Engineered fill.
  - 6. Existing Trees to remain:
    - a. Verify the locations of existing trees to be preserved.

- b. Replace existing trees to remain that are damaged during construction at no additional cost to the District and provide replacement specimens of same species per coordination with the Project Manager.
    - c. Carefully make clean cuts at roots and branches of trees indicated to be left standing, where such roots and branches obstruct new construction. Paint cuts over ½ inch in size with tree pruning compound.
  7. Contact District Arborist 48 hours prior to cutting any trees
- C. Topsoil:
  1. Strip topsoil to whatever depths encountered in manner to prevent intermingling with the underlying subsoil or other objectionable material.
  2. Remove heavy growths of grass from areas before stripping. Where trees are indicated to be left standing, stop topsoil stripping a sufficient distance to prevent damage to the main root system.
  3. Stockpile topsoil in storage piles to freely drain surface water.
  4. Cover storage piles if required to prevent windblown dust.

### **3.3 EXISTING UTILITIES**

- A. Protect existing utilities that are to remain in operation as specified.
- B. Demolish and completely remove from the site existing underground utilities indicated and/or required to be removed in order to complete the work. See Section 02200 – SITE PREPARATION.
- C. Movement of construction machinery and equipment over existing pipes and utilities during construction shall be at contractor's risk.
- D. Excavation made with power-driven equipment is not permitted within 2 feet of any known utility or subsurface structure.
  1. Use hand or light equipment for excavating immediately adjacent to or for excavations exposing a utility or buried structure.
  2. Start hand or light equipment excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured.
  3. Preserve and irrigate removed sections of existing turf for salvage and/or replacement and restoration.
  4. Support uncovered lines or other existing work affected by excavation until approval for backfill is obtained.
  5. Report damage of utility line or subsurface structures immediately to Project Manager

### **3.4 PREPARATION OF SUBGRADE**

- A. Expansive soils are anticipated to present on-site.
  1. Review the necessity for overexcavation of expansive soils.
- B. Scarify building pad, exterior flatwork and pavement subgrade to a depth of at least 6 inches and work until uniform and free from large clods.
  1. Bring expansive subgrades to at least 3 percentage points above the optimum moisture content and compact from 87 to 90 percent of the maximum laboratory dry density, in accordance with ASTM D1557.
  2. Bring nonexpansive subgrades to or slightly above the optimum moisture content and compact to 90 percent of the maximum laboratory dry density in accordance with ASTM D1557.

3. Increase compaction of the upper 6 inches of pavement subgrades to 95 percent of the maximum laboratory dry density per ASTM D1557 for nonexpansive subgrades.
4. Finished subgrade should be observed and determined to be stable by the Geotechnical Engineer.
5. Non-approved subgrade areas shall be repaired at no additional cost to the District.

### **3.5 DEWATERING**

- A. Do not allow water from surface drainage or underground sources to accumulate in excavations, unfinished fills, or other low areas.
- B. Provide and maintain ample means and devices to remove water promptly and dispose properly of water entering excavations or other parts of the work to prevent softening of exposed surfaces.
- C. Dewater by methods which will ensure dry excavation and preservation of finish lines and grades of excavation bottoms.
- D. Prior to excavating below ground water level, place dewatering system in operation.
  1. Lower the ground water level a minimum of 2 feet below the bottom of the excavation.
  2. Relieve the hydrostatic pressure in pervious zones below the subgrade elevation to prevent uplift.
  3. Use screens and gravel packs as necessary to prevent removal of fines from the soil.
- E. Operate the dewatering system continuously, 24 hours a day, 7 days a week until construction work below existing ground water level is completed.
  1. Measure and record the performance of the dewatering system.
    - a. Perform at the same time each day.
    - b. Use piezometers and observation wells.
  2. After placement of initial slabs and backfill, the ground water level may be allowed to rise.
  3. At no time allow ground water to rise higher than 1 foot below the prevailing level of excavation or backfill.
  4. Have a back-up pump and system available for immediate use.
- F. Dispose of water away from the work in suitable manner without damage to adjacent property or menace to public health.
- G. Do not drain water into work being built or under construction without prior acceptance of the Project Manager.
- H. Protect existing storm drainage system from silt and debris resulting from construction activities. If contamination occurs, remove contamination at no cost to the District.

### **3.6 SITE EXCAVATION**

- A. General
  1. All supports, shoring, and sheet piling required for the sides of excavations or for protection of adjacent existing improvements shall be provided and maintained by the Contractor. The adequacy of such systems shall be the complete responsibility of the Contractor.
  2. Earth and rock, regardless of character and subsurface conditions, shall be excavated to depths shown on plans and to the neat dimensions of the footings wherever practicable, to permit pouring of footings and grade beams without use of side forms, except at slab perimeters.
  3. Large rocks, pieces of concrete or other obstructions, if encountered during the excavation/scarifying operations, shall be removed and disposed of by the Contractor off the site in a legal manner.

4. Where footing excavation is too deep, backfill shall be concrete. Where footings are over dug laterally, side forms shall be employed for backfill with rock fill or concrete backfill shall be used (Contractor's option).
  5. Where forming is required, only that excavation necessary to permit placing and removal of forms shall be done.
  6. Bottoms of all footings and foundations trenches shall be observed by the Geotechnical Engineer. Corrective measures as directed by the Project Manager shall be executed promptly.
- B. Excavate subgrade as required to allow for finish grades shown on plans, as required for structural fill or otherwise required for proper completion of the work.
- C. Remove and replace subgrade materials designated by Geotechnical Engineer as unsuitable.

### **3.7 FILL AND COMPACTING**

- A. See Section 31 23 33 – TRENCHING, BACKFILLING, & COMPACTING for fill and compacting requirements.

### **3.8 MOISTURE CONTROL**

- A. Do not place, spread or roll fill material during unfavorable weather conditions or when fill material is excessively wet.
- B. Do not resume operations until moisture content and fill density are satisfactory to the Geotechnical Engineer.
- C. Provide berms or channels to prevent surface water from flooding excavations. Promptly remove water collecting in depressions.
- D. Where soil has been softened or eroded by flooding or by placement during unfavorable weather, remove damaged areas and recompact as described for fill and compaction.
1. Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material.
  2. Prevent free water appearing on surface during or subsequent to compaction operation.
  3. Remove and replace, or scarify and air dry, soil material too wet to permit compaction to specified density.
  4. Soil material removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing, turning, or pulverizing until moisture content is reduced to a satisfactory value.

### **3.9 GRADING**

- A. General: Uniformly grade areas of work including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.
1. All areas covered by the project, including excavated and filled areas and adjacent transition areas, shall be uniformly graded so that finished surfaces are at the elevations established by the plans. Planter areas to receive future topsoil shall be graded below finished grade to allow for such material.
  2. Finished surfaces and surfaces to receive paving and aggregate base shall be smooth, compacted, free from irregular surface drainage, and determined to be stable by the Geotechnical Engineer.
  3. Ditches, gutters, and swales shall be finished to permit proper surface drainage.
  4. All surface areas, except paved and sloped embankments exceeding 8:1, shall be hydroseeded.

- B. Grading Tolerances:
1. Excavations shall not exceed 0.10-foot variation from dimensions and elevations shown or noted, unless otherwise approved by Project Manager.
  2. Fill and backfill shall be placed with tolerance of plus or minus 0.10 foot if placed in layers.
  3. Grading shall be done within plus or minus 0.10 foot typically; areas under slabs, walks or pavements shall be graded within tolerance of 0 to 0.10 foot.
  4. Lawn or Unpaved Areas: Finish areas to receive topsoil to within not more than 0.10 foot above or below required subgrade elevations.
  5. Walks: Shape surface of areas under walks to line, grade and cross-section, with finish surface not more than 0.10 foot above or below required subgrade elevation.
  6. Pavements: Shape surface of areas under pavement to line, grade and cross-section, with finish surface not more than ½ inch above or below required subgrade elevation.
- C. Compaction: After grading, compact subgrade surfaces to the depth and percentage of maximum density for each area classification.

### **3.10 SOIL STERILIZATION**

- A. General: Soil sterilant shall be applied to prepared subgrade or after installation of rock or aggregate base as recommended by the manufacturer. Sterilant shall be applied uniformly at the rate recommended by the manufacturer to all areas beneath asphalt concrete pavement, brick pavement, concrete pavement, or on-grade concrete slabs including sidewalks, curbs, and gutters and areas between the inner and outer security fences. In addition to ground areas treated, sterilant shall be applied below expansion or control joints, and at all areas where pipe, ducts, or other features penetrate slabs.

### **3.11 TERMITICIDE**

- A. Termiticide shall be applied to soils as recommended by the manufacturer. Termiticide shall be applied uniformly at the rate recommended by the manufacturer to all areas beneath and around wood frame structures.

### **3.12 DISPOSAL OF EXCESS AND WASTE MATERIALS**

- A. Removal of Excess Excavated Material: Excess material shall be removed by the Contractor off the site in a legal manner.

### **3.13 FIELD DENSITY TESTS**

- B. Testing Agency Services: Allow testing agency to inspect and test each subgrade and each fill or backfill layer. Do not proceed until test results for previously completed work verify compliance with requirements.
1. Perform field in-place density tests according to ASTM D1556 (sand cone method), ASTM D2167 (Rubber Balloon Method), or ASTM D2937 (Drive Cylinder Method), as applicable.
    - a. Field in-place density tests may also be performed by the nuclear method according to ASTM D2922, provided that calibration curves are periodically checked and adjusted to correlate to tests performed using ASTM D1556. With each density calibration check, check the calibration curves furnished with the moisture gauges according to ASTM D3017.
    - b. When field in-place density tests are performed using nuclear methods, make calibration checks of both density and moisture gauges at beginning of work on each different type of material encountered, and at intervals as directed by the Project Manager.
  2. Footing Subgrade: At footing subgrades, perform at least one test of each soil stratum to v



verify design bearing capacities. Subsequent verifications and approval of other footing subgrades may be based on a visual comparison of each subgrade with related tested strata when acceptable to the Project Manager.

3. Paved and Building Slab Areas; At subgrade and at each compacted fill and backfill layer, perform at least one field in-place density test for every 2,000 square feet or less of paved area or building slab, but in no case fewer than three tests.
  4. Foundation Wall Backfill: In each compacted backfill layer, perform at least one field in-place density test for each 100 feet or less of wall length, but no fewer than two tests along a wall face.
  5. Trench Backfill: In each compacted initial and final backfill layer, perform at least one field in-place density test for each 150 feet or less of trench, but not fewer than two tests.
- C. Number and location of test shall be at option of the Geotechnical Engineer.
- D. When testing agency reports that subgrades, fills, or backfills are below specified density, scarify and moisten or aerate, or remove and replace soil to the depth required, recompact and retest until required density is obtained.
- E. After grading is completed and the testing agency has completed observation of the work, permit no further excavation or filling, except as approved by Project Manager.

### **3.14 PROTECTION**

- A. Protect newly graded areas from traffic and erosion. Install erosion control mat and straw wattles as directed by the Project Manager. Keep free of trash and debris.
- B. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.
- C. Where completed compacted areas are disturbed by subsequent construction operation or adverse weather, scarify surface, reshape, compact to required density and provide other corrective work, including retesting, prior to further construction.

### **3.15 CLEAN-UP**

- A. Comply with requirements of Section CLEANING.

End of Document



## **Section 31 10 00 SITE PREPARATION**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. This section describes general requirements, products, and methods of execution relating to site preparation, unless otherwise noted. This section applies to:
  - 1. Surface and subsurface demolition.
  - 2. Backfilling of excavations and depressions.
  - 3. Coordination, demolition and/or relocation of existing utilities.
  - 4. Prior to start of demolition of facilities, shut-off, disconnect, cut, and cap where required, underground utility services to facilities.
  - 5. Removal of A.C. pavement driveway and concrete pavement, concrete pads, and A.C. curbing.
  - 6. Removal of cyclone wire, wood fences and barricades.
  - 7. Removal of storm drainage piping, catch basins, and manholes.
  - 8. Removal of vegetation and trees as specified herein.
  
- B. Contractor shall provide labor, material and equipment required for demolishing, cutting, removing and disposing of existing construction as designated and shown on the Plans for the following as required, unless otherwise noted.
  
- C. Related Sections:
  - 1. Section 31 10 00- EARTHWORK AND GRADING.
  - 2. Section 31 23 33- TRENCHING, BACKFILLING, AND COMPACTING.

#### **1.2 SUBMITTALS**

- A. Comply with requirements of Section SUBMITTAL PROCEDURES.
  
- B. Submit all permits and certificates required for the project, for record purposes.
  
- C. Demolition schedule and proposed methods and operations.
  
- D. Permits and notices authorizing demolition.
  
- E. Letter or certificates of severance of utilities services from the affected agencies or utilities.
  
- F. Proposed haul route(s) from the demolition worksite to an authorized disposal site.
  
- G. Permit for transport and disposal of debris.
  
- H. Make arrangements of disposing of waste and excess materials at a legally licensed landfill/disposal facility outside worksite and pay cost thereof.

- I. Photograph existing conditions of existing structure surfaces, equipments, and adjacent improvements that might be misconstrued as damage related to removal operations. File photographs with Project Manager prior to start of work.
- J. Submit Proposed dust control measures.
- K. Submit Proposed noise control measures.
- L. Work Schedule: Submit a proposed schedule of work items to be performed, and a description of how the work is to be accomplished, for the Project Manager's review.
- M. Report of inspections conducted with the Project Manager before and after performing work.

### **1.3 QUALITY ASSURANCE**

- A. Comply with the following Standards: American National Standards Institute, Inc. "American National Standard Safety Requirements for Demolition" (ANSI A10.6 and A10.8).
- B. Regulatory Agencies:
  - 1. Comply with rules and regulations of State of California, California Code of Regulations, Title 8, Industrial Relations, Chapter 4, Subchapter 4, "Construction Safety Order."
  - 2. Comply with applicable local and state agencies having jurisdiction.
  - 3. Comply with governing EPA notification regulations.
- C. Secure all required Permits or Certificates for demolition or discontinuance of utilities, prior to beginning the work.

### **1.4 PROJECT CONDITIONS**

- A. Disposition of Existing Improvements:
  - 1. All materials indicated to be removed shall become the property of the Contractor; dispose of these outside the project site.
    - a. Do not dispose of removed materials to the general public by sale, gift or in any other manner at the Site.
    - b. These provisions shall not be construed as limiting or prohibiting sale or disposal of such materials at the Site to duly licensed Contractors or material suppliers, provided materials are removed from the construction site by the Contractor.
  - 2. All removal of debris from the site, including removal of inventory to site of storage, is part of this Contract and shall be done by Contractor's employees and no others.
- B. Salvage and Reuse:

1. Where units or items of existing work are designated to be removed and reused in the new work or are to become salvage, remove such units or items carefully.
  - a. Use tools and methods that will not damage such units or items.
  - b. Protect underlying or adjoining work from damage.
  - c. Salvaged items shall be cleaned by the Contractor.

C. Protection:

1. Erect and maintain temporary bracing, shoring, lights, barricades, except construction barricades for subsequent new construction, warning signs, and guards necessary to protect public, the District's employees, finishes, improvements to remain and adjoining property from damage, all in accordance with applicable regulations.
2. Wet down areas affected by this work as required preventing dust and dirt from rising.

D. Scheduling:

1. Coordinate with the District in scheduling noisy or dirty work.
2. Schedule work at the District's convenience to cause minimal interference with the District's normal operations.
3. Jackhammering shall be coordinated with the District and College to minimize disturbance of classes.

E. Traffic Circulations: Ensure minimum interference with roads, streets, driveways, sidewalks, and adjacent facilities.

1. Do not close or obstruct public thoroughfares without first obtaining the required permit or permission of the responsible jurisdiction.
2. Where closing of a vehicular or pedestrian traffic circulation route is necessary, provide adequate directional signs to minimize the potential for confusion.

## **PART 2 - PRODUCTS**

Not used.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine areas affected by work of this Section and verify following:
1. Disconnection of utilities as required.
  2. That utilities serving occupied portions of buildings on and off the site will not be disturbed or that temporary utility services have been provided.
  3. Removal by the District of the District's personal property, movable furniture and equipment items not designated for relocation.
- B. Where existing conditions conflict with representations of the Construction Documents, notify the Project Manager and obtain clarifications. Do not perform

work affecting the conflicting conditions until clarification of the conflict is received.

### **3.2 PREPARATION**

- A. Verify that the area to be demolished or removed has been vacated, or adequate space made available to perform the work.
- B. Arrange for, and verify termination of utility services to include removing meters and capping of lines.
- C. Lay out cutting work at Job Site and coordinate with related work for which cutting is required.

### **3.3 DEMOLITION**

- A. If confirmed or suspected hazardous materials are encountered during operations, stop operations immediately and notify the Project Manager.
- B. Perform work in accordance with ANSI A10.6-1969 unless otherwise noted.
- C. Provide noise and dust abatement as required to prevent contamination of adjacent areas.
  - 1. Remove all materials not designated as salvage, in their entirety.
  - 2. Remove building foundations in their entirety, unless otherwise indicated on the plans.
- D. Fill voids in the land left by the removal of existing structures as follows:
  - 1. In accordance with the requirements of Section 31 00 00 – EARTHWORK AND GRADING. Grade finished remaining surface to the contours shown, or if not shown, to match the existing natural contours.
- E. Lower, or remove, heavy structural framing members by hoist or crane.
- F. Concrete and Masonry:
  - 1. Demolish concrete and masonry in sections, less than 3 feet in any direction.
  - 2. Method of cutting shall be limited to saw cutting and torch.

### **3.4 CUTTING**

- A. Make new openings neat.
- B. Do not cut or alter structural members and any utilities including appurtenances unless indicated to do so in the Construction Documents, or written approval is received from the Project Manager.
- C. Take care not to damage reinforcing or structural steel scheduled to remain in place.

- D. Concrete: Cut new openings in concrete by coring and saw cutting. Saw run-bys will not be permitted.

### **3.5 PREPARATION FOR NEW FINISH WORK**

- A. Where demolished surfaces are scheduled to receive new finishes, Contractor shall restore such substrate to a condition ready to receive the scheduled new finishes, including grinding or leveling.

### **3.6 DISPOSAL OF DEMOLISHED MATERIALS**

- A. Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.
- B. Burning of demolished materials off District's property in a legal manner.

### **3.7 FIELD QUALITY CONTROL**

- A. The Project Manager will accompany the Contractor before and after performance of work to observe physical condition of existing structures or improvements involved.

End of Document





## **Section 31 23 33**

# **TRENCHING, BACKFILLING AND COMPACTING**

### **PART 1 – GENERAL**

#### **1.1 SUMMARY**

- A. Provide labor, material, equipment, and services necessary to complete the backfilling and compacting as necessary for this project. Section includes, but is not limited to:
  - 1. Select Backfill Material.
  - 2. Aggregate Base.
  - 3. Detectable Tape.
  - 4. Trench Excavation.
  - 5. Pipe Bedding.
  - 6. Trench Backfill.
  - 7. Trench Surfacing.
  
- B. Work specified in Related Sections:
  - 2. Section 31 00 00 – EARTHWORK AND GRADING
  - 5. Section 33 40 00 – STORM DRAINAGE

#### **1.2 DEFINITIONS**

- A. Engineered Fill:
  - 1. Soil or soil-rock material approved by the Project Manager or the Geotechnical Engineer-of-Record (EOR) and transported to the site by the Contractor in order to raise grades or to backfill excavations.
  - 2. Contractor shall provide sufficient tests, and a written statement that all materials brought onto the project site comply with specification requirements. Test data/results should not be older than six (6) months from the import date.
  
- B. Excavation: Consists of the removal of material encountered to subgrade elevations.
  
- C. Subgrade: The uppermost surface of an excavation or the top surface of a fill or backfill immediately below base.
  
- D. Base: The layer placed between the subgrade and surface pavement in a paving system.
  
- E. Relative Compaction: In-place dry density of soil expressed as percentage of maximum dry density of same materials, as determined by laboratory test procedure American Society for Testing and Materials (ASTM) D1557 latest version.

#### **1.3 SYSTEM DESCRIPTION**

- A. Requirements:
  - 1. Comply with the recommendations of the Geotechnical Engineer.
  - 2. Protect existing trees to remain. No grading is permitted under the drip line of protected trees.
  - 3. Excavations for appurtenant structures, such as, but not limited to, manholes, transition structures, junction structure, vaults, valve boxes, catch basins, thrust blocks, and boring pits, shall be deemed to be in the category of trench excavation.
  - 4. Unless otherwise indicated in the Plans, all excavation for pipelines shall be open cut.

## 1.4 SUBMITTALS

- A. Comply with provisions of Section 01 32 19 – SUBMITTAL PROCEDURES.
- B. Test Reports: Submit the following report for import material directly to the Project Manager from the Contractor’s testing services:
  - 1. Test data reports for aggregate base.
- C. Submit description of compactors proposed for use when requesting placement of base material.

## 1.5 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies:
  - 1. Comply with State of California Business and Transportation Agency, Department of Transportation (Caltrans) latest edition of “Standard Specifications.” (CSS).
  - 2. Comply with State of California Code of Regulations (CCR).
  - 3. Comply with State of California Construction Safety Orders, Latest Edition (CAL/OSHA).
- B. Soil Testing:
  - 1. District to engage a geotechnical testing agency, to include compaction testing and for quality control testing during fill operations.
  - 2. Test results will be submitted to the Project Manager.
- C. Codes and Standards:
  - 1. Perform excavation work in compliance with applicable requirements of authorities having jurisdiction.
  - 2. California Department of Transportation (CDT):
    - a. Section 19: Earthwork.
    - b. Standard Test Methods: No. 202.
  - 3. American Society for Testing and Materials (ASTM):
    - a. D1556: Density of Soil by the Sand Cone Method.
    - b. D1557: Moisture Density Relations of Soils and Soil-Aggregate Mixtures

## 1.6 DELIVERY, STORAGE AND HANDLING

- A. Protect materials before, during and after installation.
- B. Comply with provisions of Section 01 51 00 - TEMPORARY FACILITIES AND CONTROLS where necessary to control dust and noise on and near the work caused by operations during construction activities.

## 1.7 PROJECT CONDITIONS

- A. Environmental Requirements:
  - 1. Protect existing storm drainage system from silt and debris resulting from construction activities. If contamination occurs, remove contamination at no cost to the District.
  - 2. Protect existing streams, ditches and storm drain inlets during work on this project.
- B. Barricade open excavations and post with warning lights.
  - 1. Comply with requirements of Section 01 51 00 - TEMPORARY FACILITIES AND CONTROLS.
  - 2. Operate warning lights and barricades as required.
  - 3. Protect structures, utilities, sidewalks, pavements, and other facilities immediately adjacent to excavations, from damages caused by settlement, lateral movement, undermining,

washout, and other hazards.

- C. Protection of Subgrade: Do not allow equipment to pump or rut subgrade, stripped areas, footing excavations, or other areas prepared for project.
- D. Transport all excess soils materials by legally approved methods to disposal areas. All excess soils are to be disposed of offsite by the contractor.
  - 1. Coordinate with the Project Manager.
  - 2. Any additional fill requirements shall be the responsibility of the Contractor.

## 1.8 EXISTING UTILITIES

- A. Locate existing underground utilities in the areas of work. For utilities that are to remain in place, provide adequate means of protection during excavation operations.
  - 1. Locating of existing underground utilities shall include but not be limited to pot-holing prior to the start of construction.
- B. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult Project Manager, Facilities, and/or utility agency immediately for directions.
  - 1. Cooperate with the Project Manager and public and private utility companies in keeping their respective services and facilities in operation.
  - 2. Repair damaged utilities to the satisfaction of the agency with jurisdiction.
- C. Do not interrupt existing utilities serving facilities occupied and used by the District or others, except when permitted in writing by the Project Manager and then only after acceptable temporary utility services have been provided.

## 1.9 SEQUENCING AND SCHEDULING

- A. The sequence of operations shall be reviewed by the Project Manager prior to commencement of any work.

## PART 2 – PRODUCTS

### 2.1 MATERIALS

- A. General:
  - 1. Import materials will be subject to approval of the Geotechnical Engineer.
  - 2. For approval of imported fill material, notify the Project Manager at least 7 days in advance of intention to import material.
- B. Select backfill material shall be gravel, free of clay or organic matter and shall conform to the following gradation:

<u>Sieve Size</u>	<u>Percentage Passing</u>
1 inch	100
¾ inch	90 – 100
No. 4	35 – 60
No. 200	2 - 9

- C. For gas pipe and fuel piping select backfill shall be clean, graded building sand conforming to the following gradation:

<u>Sieve Size</u>	<u>Percentage Passing</u>
No. 4	100
No. 200	0 - 5

- D. Water: Clean and free from deleterious amounts of acids, alkalis, salts and organic matter.

## **2.2 BURIED WARNING AND IDENTIFICATION TAPE**

- A. Polyethylene plastic and metallic core or metallic-faced, acid- and alkali-resistant, polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 75 mm 3 inch minimum width, color coded as specified below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Color and printing shall be permanent, unaffected by moisture or soil.
1. Warning Tape Color Codes.  
Red: Electric.  
Yellow: Gas, Oil; Dangerous Materials.  
Orange: Telephone and Other Communications.  
Blue: Water Systems.  
Green: Sewer Systems.  
White: Steam Systems.  
Gray: Compressed Air.
  2. Warning Tape for Metallic Piping: Acid and alkali-resistant polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of tape shall be 0.003 inch. Tape shall have a minimum strength of 1500 psi lengthwise, and 1250 psi crosswise, with a maximum 350 percent elongation.
  3. Detectable Warning Tape for Non-Metallic Piping: Polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of the tape shall be 0.004 inch. Tape shall have a minimum strength of 1500 psi lengthwise and 1250 psi crosswise. Tape shall be manufactured with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 920 mm 3 feet deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.

## **2.3 DETECTION WIRE FOR NON-METALLIC PIPING**

- A. Detection wire shall be insulated single strand, solid copper with a minimum of 12 AWG.

## **PART 3 – EXECUTION**

### **3.1 GENERAL**

- A. Prior to commencement of work, become thoroughly familiar with site conditions.
- B. In the event discrepancies are found, immediately notify the Project Manager in writing, indicating the nature and extent of differing conditions.
- C. Backfill excavations as promptly as work permits.
- D. Do not place Engineered fill or backfill until rubbish and deleterious materials have been removed and areas have been approved by the Project Manager or Geotechnical Engineer.
- E. Place acceptable soil material in layers to required subgrade elevations, for each area classification listed below.
- F. In excavations, use satisfactory excavated or borrow material.

- G. Under grassed areas, use satisfactory excavated or borrow material.

### **3.2 COMPACTING**

- A. Compact by power tamping, rolling or combinations thereof.
  - 1. Where impractical to use rollers in close proximity to walls, stairs, etc., compact by mechanical tamping or approved alternative by the Project Manager or Geotechnical Engineer.
  - 2. Scarify and recompact any layer not attaining compaction until required density is obtained.

### **3.3 SITE PREPARATION**

- A. Protect structures, utilities, sidewalks, pavements, and other facilities, which are to remain, from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Protect existing storm drainage system from silt and debris resulting from construction activities. If contamination occurs, remove contamination at no cost to the District.

### **3.4 EXISTING UTILITIES**

- A. Identify the location of existing utilities.
  - 1. Prior to trenching, the Contractor shall excavate at locations specifically indicated on the Plans, if any, and where new lines cross other utilities of uncertain depth and determine the elevation of the utility in question to ensure that the new line will clear the potential obstruction.
  - 2. The Contractor shall contact Underground Service Alert (USA) at 1-800-227-2600 for assistance in locating existing utilities.
  - 3. If, after the excavation, a crossing utility does present an obstruction, then the line and grade of the new line will be adjusted as directed by the Project Manager to clear the utility.
- B. Protect all existing utilities to remain in operation.
- C. Movement of construction machinery and equipment over existing pipes and utilities during construction shall be at Contractor's risk.
- E. Excavation made with power-driven equipment is not permitted within 2 feet of any known utility or subsurface structure.
  - 1. Use hand or light equipment for excavating immediately adjacent to known utilities or for excavations exposing a utility or buried structure.
  - 2. Start hand or light equipment excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured.
  - 3. Support uncovered lines or other existing work affected by excavation until approval for backfill is obtained.
  - 4. Report damage of utility line or subsurface structures immediately to the Project Manager.
- F. Backfill trenches resulting from utility removal in lifts of 8 inches maximum.

### **3.5 TRENCH EXCAVATION**

- A. General
  - 1. Excavation shall include removal of all water and materials that interfere with construction. The Contractor shall remove any water which may be encountered in the trench by pumping or other methods during the pipe laying, bedding and backfill operations. Material shall be sufficiently dry to permit approved jointing.

2. Excavation shall include the construction and maintenance of bridges required for vehicular and pedestrian traffic, support for adjoining utilities.
  3. The Contractor shall be responsible to safely direct vehicular and pedestrian traffic through or around his/her work area at all times.
  4. The Contractor shall relocate, reconstruct, replace or repair, at his/her own expense, all improvements which are in the line of construction or which may be damaged, removed, disrupted or otherwise disturbed by the Contractor.
- B. Existing Paving and Concrete:
1. Existing pavement over trench shall be sawcut, removed, and hauled away from the job. Existing pavement shall be neatly sawcut along the limits of excavations.
  2. Existing concrete over the trench shall be sawcut to a full depth in straight lines either parallel to the curb or a right angles to the alignment of the sidewalk.
  3. Boards or other suitable material shall be placed under equipment outrigging to prevent damage to paved surfaces.
- C. Trench Width:
1. The maximum allowable trench widths at the top of the pipe shall be as follows:

<u>Pipe Type</u>	<u>Trench Width (Maximum)</u>
Copper	Outside diameter of barrel plus 18 inches
Plastic	"
Vitrified Clay	"
Ductile-Iron	"
Reinforced Concrete	"

    - a. The maximum trench width shall be inclusive of all shoring.
    - b. If the maximum trench width is exceeded, the State's representative may direct the Contractor to encase or cradle the pipe in concrete at no additional charge.
  2. For pipes 3 inch diameter and larger, the free working space on each side of the pipe barrel shall not be less than 6 inches.
- D. Open Trench:
1. The maximum length of open trench shall be 300 feet or the distance necessary to accommodate the amount of pipe installed in a single day, whichever is greater. No trench shall be left open at the end of the day.
  2. Provisions for trench crossings and free access shall be made at all street crossings, driveways, water gate valves, and fire hydrants.
- E. Excavation Bracing:
1. The excavation shall be supported and excavation operations shall be conducted in accordance with the California Industrial Accident Commission and CAL/OSHA.
  2. The Contractor shall, at his/her own expense, furnish, put in place, and maintain such sheeting and bracing as may be required to support the sides of all excavations (whether above or below the pipe grade), and to prevent any movement which could in any way diminish the required trench section or otherwise injure or delay the work. The sheeting and bracing shall be withdrawn in a manner such as to prevent any earth movement that might overload the pipe.
- F. Excavated Material:
1. All excavated material not required for backfill shall be immediately removed and properly disposed of in a legal manner by the Contractor.
  2. Material excavated in streets and roadways shall be laid alongside the trench no closer than 2 feet from the trench edge and kept trimmed to minimize inconvenience to public traffic.
  3. Provisions shall be made whereby all storm and wastewater can flow uninterrupted in gutters or drainage channels.

### 3.6 PIPE BEDDING

- A. Bedding Excavation: The trench shall be excavated below the grade of the pipe bottom to the following minimum depths:

<u>Pipe Type</u>	<u>Depth</u>
Copper	6 inch
Reinforced Concrete	6 inch
Plastic: 2 inch diameter and smaller	6 inch
Plastic: over 2 inch diameter	6 inch
Ductile Iron	6 inch

1. Stabilization of Trench Bottom: When the trench bottom is unstable due to wet or spongy materials, trench bottom shall be stabilized with gravel or crushed rock. The State's inspector and/or Geotechnical Engineer will determine the suitability of the trench bottom and the amount of gravel or crushed rock needed to stabilize a soft foundation. Soft material shall be removed and replaced with gravel or crushed rock as necessary.
2. Placement of Bedding Material: The trench bottom shall be cleaned to remove all loose native material prior to placing select backfill material. Sufficient select backfill material shall be placed in trench and tamped to bring trench bottom up to grade of the bottom of pipe. The relative compaction of tamped material shall be not less than 90 percent. It is the intention of these requirements to provide uniform bearing under the full length of pipe to a minimum width of 60 percent of the external diameter.

### 3.7 TRENCH BACKFILL

- A. Initial Backfill:

1. Prior to trench backfill, the condition of the trench and laying of pipe must be inspected and approved by the Inspector of Record.
2. Select backfill material shall be used for initial backfill. After the pipe has been properly laid and inspected, select backfill material shall be placed on both sides of the pipe and compacted to final depth as follows:

<u>Pipe Type</u>	<u>Depth</u>
Copper	12 inches above top of pipe
Plastic: less than 3 inches diameter	12 inches above top of pipe
Plastic: 3 inches diameter and larger	12 inches above top of pipe
Ductile Iron	12 inches above top of pipe
Reinforced Concrete	12 inches above top of pipe

3. Compaction: Initial backfill compaction shall be by mechanical means. The initial backfill material shall be hand tamped in layers not exceeding 4 inches in uncompacted depth and shall be brought up uniformly on both sides of the pipe to avoid bending or distortional stress. After hand tamping, the relative compaction of the initial backfill material shall be not less than 90 percent.
4. Pipe Detection: In trenches containing pressurized plastic pipes, tracer wire shall be placed directly above the pipe and shall be connected to all valves, existing exposed tracer wires, and other appurtenances as appropriate.

- B. Subsequent Backfill:

1. Above the level of initial backfill, the trench shall be backfilled with moderately-expansive native material (as defined in the geotechnical report) from trench excavation or with imported select backfill material (Contractor's option). Subsequent backfill shall be free of vegetable matter, stones or lumps exceeding 3 inches in greatest dimension, and other unsatisfactory material. The Inspector of Record shall approve the backfill material prior to placement.
2. Subsequent backfill compaction shall be by mechanical means with backfill material placed in layers not exceeding 8 inches in loose depth. Each layer shall be thoroughly compacted

before succeeding layers are placed. The use of machine tampers, except manually held types, shall not be permitted.

3. Subsequent backfill shall be compacted to a relative compaction of not less than 90 percent except the relative compaction shall not be less than 95 percent within the upper 6 inches of pavement subgrade.

C. Jetting and Ponding:

1. Jetting of trench backfill is not permitted.

D. Compaction Testing:

1. Compaction testing shall be inspected and tested by the Geotechnical Consultant during placement. Cooperate with the Geotechnical Consultant and provide working space for such tests in operations. Backfill not compacted in accordance with these specifications shall be re-compactd or removed as necessary and replaced to meet the specified requirements, to the satisfaction of the Geotechnical Consultant and the Owner's Representative prior to proceeding with the Project.

### 3.8 TRENCH SURFACING

A. Unpaved Areas:

1. In unimproved areas, the trench surface shall be restored to its original condition. No mounds of earth shall be left along the trench. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.
2. Where completed compacted areas are disturbed by subsequent construction operation or adverse weather, scarify surface, reshape, compact to required density and provide other corrective work, including retesting, prior to further construction.

B. Temporary Surfacing:

1. Temporary surfacing shall be a minimum of 2 inches of cutback asphalt on 10 inches of Class 2 aggregate base and shall be placed at all trench locations subject to vehicular or pedestrian traffic.
2. Temporary surfacing shall be laid within one day after backfilling (except where the Contractor elects to place permanent surfacing within this time period).
3. Before the trenching area is opened for traffic, all excess dirt, rock, and debris shall be removed, the street surface shall be swept clean and the pavement shall be washed down with a water truck and pressure nozzle.
4. Temporary surfacing shall be maintained to prevent the occurrence of mudholes and prevent the surface from settling below 1 inch or rising more than 1 inch from the existing pavement grade.

### 3.9 FILL AND COMPACTING

A. General Requirements:

1. Backfill excavations as promptly as work permits.
2. Do not place Engineered fill or backfill until rubbish and deleterious materials have been removed and areas have been approved by the Project Manager.
3. Place acceptable soil material in layers to required subgrade elevations, for each area classification listed below.
4. In excavations, use satisfactory excavated or borrow material.
5. Under grassed areas, use satisfactory excavated or borrow material.

B. After subgrade compaction has been approved by the Geotechnical Engineer, spread the Engineered fill materials in 6 to 8 inch loose lifts and uniformly mixed during the spreading operation.

1. Bring non-expansive fill materials to or slightly above the optimum moisture content and compacted to at least 90 percent of the maximum laboratory dry density, per ASTM D1557



- latest version.
  - 2. Bring non-expansive aggregate fill materials to or slightly above the optimum moisture content and compacted to at least 95 percent of the maximum laboratory dry density, per ASTM D1557 latest version.
  - 3. Do not compact the top 12 inches of soil in the planting areas.
  - 4. Fill sections greater than 5 feet in depth shall be compacted to at least 95 percent.
- C. Repeat compaction procedure until proper grade is attained.
- D. Rocks generated during site earthwork may be used in fill when conforming to material specifications.

### **3.10 MOISTURE CONTROL**

- A. Do not resume operations until moisture content and fill density are satisfactory to the Inspector.

### **3.11 DISPOSAL OF EXCESS AND WASTE MATERIALS**

- A. Testing Services: Allow testing agency to test each backfill layer. Do not proceed until test results for previously completed work verify compliance with requirements.
- B. When testing agency reports that backfills are below specified density, scarify and moisten or aerate, or remove and replace soil to the depth required, recompact and retest until required density is obtained.

### **3.12 PROTECTION**

- A. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.
- B. Where completed compacted areas are disturbed by subsequent construction operation or adverse weather, scarify surface, reshape, compact to required density and provide other corrective work, including retesting, prior to further construction.

### **3.13 CLEAN-UP**

- A. Remove all debris, equipment, tools and materials upon completion prior to final inspections to the satisfactions of the Project Manager.
- B. In unpaved areas without landscaping, cover with straw erosion control blanket. Follow manufacturer's recommendations for installation. Provide and place straw wattles or biodegradable fiber logs across the slope at the midpoint and along the downhill edge of site. No soil is to be left uncovered at the completion of construction.

End of Document



## **Section 32 10 00 DEMOLITION**

### **PART 1 – GENERAL**

#### **1.1 SUMMARY**

- A. Provide labor, material, and equipment required for demolishing, cutting, removing and disposing of existing construction as designated or required to provide for new work.
- B. Coordinate all work with capping or sealing of existing utilities.
- C. Related Sections:
  - 1. Section 31 10 00 - SITE PREPARATION
  - 2. Section 31 00 00 - EARTHWORK AND GRADING
  - 3. Section 31 23 33 - TRENCHING, BACKFILLING, AND COMPACTING

#### **1.2 SUBMITTALS**

- A. Comply with requirements of the SUBMITTAL PROCEDURES and GENERAL CONDITIONS.

#### **1.3 QUALITY ASSURANCE**

- A. Comply with the following Standards: American National Standards Institute, Inc. "American National Standard Safety Requirements for Demolition" (ANSI A10.6 and A10.8).
- B. Regulatory Agencies:
  - 1. Comply with rules and regulations of State of California, California Code of Regulations, Title 8, Industrial Relations, Chapter 4, Subchapter 4, "Construction Safety Order."
  - 2. Comply with applicable local and state agencies having jurisdiction.
  - 3. Comply with governing EPA notification regulations.
  - 4. Comply with applicable state and local regulations regarding dust and noise mitigation during construction.
- C. Secure all required Permits or Certificates for demolition prior to beginning the work.

#### **1.4 PROJECT CONDITIONS**

- A. District assumes no responsibility for actual condition of the site to be altered.
  - 1. Conditions existing at time of inspection for bidding purpose will be maintained by District as far as practical.
  - B. Disposal of Existing Improvements:
    - 1. All materials removed shall become the property of the Contractor; dispose of these materials outside the project site.
      - a. Do not dispose of removed materials to the general public by sale, gift or in any other manner at the project site.
      - b. These provisions shall not be construed as limiting or prohibiting sale or disposal of such materials at the Site to duly licensed Contractors or material suppliers, provided materials are removed from construction site by the Contractor.
    - 2. All removal of debris from the site, including removal of inventory to site of

storage, is part of this Contract and shall be done by Contractor's employees and no others.

- C. Salvage:
1. Recycle AC pavement and Class II AB where practical.
  2. Recycle concrete where practical.
  3. Items indicated to be salvaged shall be removed carefully, cleaned, and returned to the District. Coordinate with the Project Manager.
- D. Protection:
1. Erect and maintain temporary bracing, shoring, lights, barricades, except construction barricades for subsequent new construction, warning signs, and guards necessary to protect public, the District's employees, adjacent improvements to remain, and adjoining property from damage, all in accordance with applicable regulations.
  2. Wet down areas affected by this work as required to prevent dust and dirt from rising.
- E. Scheduling:
1. Coordinate with the Project Manager in scheduling noisy or dirty work.
  2. The Project Manager will supply a schedule of days on which no construction will be allowed.
  3. Contractor shall take College schedule into consideration during construction.
  4. Coordinate and schedule temporary water shut-downs and temporary water service with the Project Manager, Facilities, and the Water Department, and the Fire Department.
- F. Traffic Circulations: Ensure minimum interference with roads, streets, driveways, sidewalks, and adjacent facilities.
1. Minimize obstruction to thoroughfares by first obtaining the required approval or permission of the responsible jurisdiction.
  2. Where closing of a vehicular traffic circulation route is necessary, provide adequate directional signs to minimize the potential for confusion. Provide access at all times for emergency vehicles.
- G. Safety:
1. The College of San Mateo campus has a history of serpentine rock. The Contractor shall take all necessary precautions to eliminate the exposure of workers, students, staff, and the public to asbestos fibers, including but not limited to: dust control measures and measures included in Sections 93106 and 93105 of California Code of Regulations, Title 17.

## **PART 2 – PRODUCTS**

Not Used

## **PART 3 – EXECUTION**

### **3.1 EXAMINATION:**

- A. Where existing conditions conflict with representations of the Construction Documents, notify the Project Manager and obtain clarifications. Do not perform work affecting the conflicting conditions until clarification of the conflict is received.

### **3.2 PREPARATION**

- A. Verify that the area to be demolished or removed has been vacated, and adequate space has been made available to perform the work.
- B. Lay out saw cutting and coordinate with related work for which saw cutting is required.
- C. Contractor shall coordinate and arrange the shut down of utilities serving the site with Facilities, the Fire Department, and the Project Manager.

### **3.3 DEMOLITION**

- A. If known or suspected hazardous materials are encountered during operations, stop operations immediately and notify the Project Manager.
- B. Perform work in accordance with ANSI A10.6-1969 unless otherwise noted.
- C. Provide noise and dust abatement as required to prevent contamination of adjacent areas.
- D. Remove all materials not designated as salvage, in their entirety.
- E. If unknown items such as human remains are encountered during operations, stop operations immediately and notify the Project Manager.
- F. The Project Manager will provide a list of any items to be stockpiled for future use. Stockpile location will be a site on campus determined by the Project Manager.

### **3.4 DEMOLITION AND REMOVAL OF AC PAVEMENT:**

- A. Sawcut pavement at edge of demolition area.
- B. Break pavement and remove.
- C. Remove any base material, gravel, and/or or any other non-native soil.

### **3.5 SAW CUTTING:**

- A. Make new openings neat.
- B. Take care not to damage existing AC pavement to remain in place.

### **3.6 UTILITY REMOVAL:**

- A. Where utility removal is shown on the plans or required for construction, excavate to expose existing utility, demolish and remove the section of pipe or conduit. Cap section of pipe or conduit to remain. Mark end of utility with 12" piece of #4 rebar.
- B. Included in demolition are any appurtenances, including but not limited to valves, valve boxes, and irrigation system components.
- C. Backfill trench in accordance with requirements of Section 31 23 33 – TRENCHING, BACKFILLING, AND COMPACTING.

### **3.7 DISPOSAL OF DEMOLISHED MATERIALS:**

- A. Promptly dispose of demolished materials. Do not allow demolished materials to

accumulate on-site.

- B. Burning of demolished materials is prohibited.

### **3.8 FIELD QUALITY CONTROL:**

- A. The Project Manager will accompany the Contractor before and after performance of work to observe physical condition of existing structures or improvements involved.

End of Document

## **Section 32 12 33**

# **PAVING AND SURFACING**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes (but is not necessarily limited to):
  - 1. Asphalt Concrete Paving.
  - 2. Concrete Paving.
  - 3. Liquid Asphalt and Asphalt Emulsion.
  - 4. Aggregate Base.
  
- B. Related work furnished under other sections but conforming to the provisions of this section:
  - 1. Subgrade preparation.
  - 2. Aggregate Base installation.
  
- C. Related Sections:
  - 1. Section 32 00 00 - DEMOLITION
  - 2. Section 31 17 23 - PAVEMENT MARKING.

#### **1.2 REFERENCES**

- A. American Society for Testing and Materials (ASTM):
  - 1. A615: Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
  - 2. C150: Portland Cement.
  - 3. D1557: Moisture Unit Weight Relations of Soils and Aggregate Mixtures Using a 10 lb (4.5 kg) Rammer and 18 in. (457 mm) Drop.
  - 4. D1682: Breaking Loads and Elongation of Textile Fabrics.
  
- B. California Code of Regulations (CCR): Title 24, Chapter 2-71, Site development Requirements for Handicapped Accessibility.
  
- C. California Department of Transportation (C.D.T.):
  - 1. Standard Specifications:
    - a. Section 26 Aggregate Bases.
    - b. Section 37 Bituminous Seals.
    - c. Section 39 Asphalt Concrete.
    - d. Section 51 Concrete Structures.
    - e. Section 52 Reinforcement.
    - f. Section 73 Concrete Curbs and Sidewalks.
    - g. Section 90 Portland Cement Concrete.
    - i. Section 92 Asphalts.
    - j. Section 93 Liquid Asphalts.
    - k. Section 94 Asphaltic Emulsions.
  - 2. Traffic Manual.
  - 3. Highway Design.
  
- D. Institute of Transportation Engineers: Transportation and Traffic Engineering Handbook.

#### **1.3 SUBMITTALS**

- A. Requirements: Refer to Section SUBMITTAL PROCEDURES.
  
- B. Asphalt Concrete Paving:

1. Provide two copies of material certificates signed by the material producer and the Contractor, certifying that each material item complies with or exceeds specified requirements.
  2. The Contractor shall furnish a certified weight or load slip for each load of material used in the construction of the asphalt concrete pavement.
- C. Concrete Paving: The Contractor shall furnish mill test reports on the cement, reinforcement bars, and aggregates, showing compliance with the respective specifications. The Testing Engineer may make concrete test cylinders and slump tests as deemed necessary to determine compliance with the Specifications.
- D. Liquid Asphalt.
- E. Pavement Reinforcement Fabric.
- F. Tack Coat.
- G. Pavement Reinforcement Mesh.
- H. Structural Geotextile Fabric.

## **1.4 PROJECT CONDITIONS**

- A. Liquid Asphalt and Asphalt Emulsion:
1. Prime coat, seal coat, and paint binder shall be applied only when the ambient temperature is above 50° Fahrenheit and when temperature has not been below 35° Fahrenheit for 12 hours immediately prior to application.
  2. Prime coat, fog coat, seal coat, and paint binder shall not be applied when base or surfaces are wet or contain excess moisture.
- B. Asphalt Concrete Paving: Asphalt concrete surfaces shall be constructed only when ambient temperature is above 50° Fahrenheit and when base is dry.

## **1.5 GENERAL DESIGN CRITERIA**

- A. Services Areas: Approach ramps, driveways, and paved work areas in excess of 4 percent slope shall be provided with a rough texture for non-skid surface.
- B. Walks and Paths: Concrete exterior slabs (walks, terraces, etc.) shall have a pitch of at least 2 percent.
- C. Pavement Markings: All traffic control striping and pavement markings shall conform to the standards illustrated in the C.D.T. Standard Plans Book issued July 1992, General Road Work Section.

## **PART 2 - PRODUCTS**

### **2.1 PAVING MATERIALS**

- A. Aggregate Base: Aggregate base shall conform to Caltrans Class 2 (R value 78 min) aggregate base, 3/4" maximum size, as specified in Section 26 of the C.D.T. Standard Specifications.
- B. Asphalt Concrete Paving:
1. Paving asphalt to be mixed with aggregate shall be steam-refined asphalt, AR-4000, conforming to Section 92 of the C.D.T. Standard Specifications.
  2. Mineral aggregate shall be Type B mineral aggregate as specified in Section 39 of the C.D.T. Standard Specifications.



3. Maximum aggregate size shall be as follows:

<u>A.C. Thickness</u>	<u>Max. Ag.</u>
a. ¾" - 1½"	1/2"
b. 2 & 2½" 1/2"	
c. 3" & 4"	3/4"
  4. Liquid asphalt for prime coat shall be Grade SC-70 in conformance with Section 93 of the C.D.T. Standard Specifications.
  5. Asphaltic emulsion for paint binder, fog coat, and seal coat shall be emulsified asphalt, Type SS-1h, conforming to Section 94 of the C.D.T. Standard Specifications.
- C. Portland Cement Concrete:
1. Concrete shall be Class A concrete conforming to Section 90 of the C.D.T. Standard Specifications.
  2. Cement shall be Type II cement conforming to ASTM C150 as modified by Section 90 of the C.D.T. Standard Specifications.
  3. Aggregate shall be ¾-inch maximum size conforming to Section 90 of the C.D.T. Standard Specifications.
  4. Water shall be potable and free of organic matter and injurious amounts of oil, acid, alkali, or other deleterious substances.
  5. Reinforcing bars shall be deformed and shall conform to ASTM A615.
  6. Filled joints, unless noted otherwise on the Drawings, shall be ¼-inch thick, the full depth of the concrete section and conforming to Section 51 of the C.D.T. Standard Specifications.
  7. Joint filler shall conform to Section 51 of the C.D.T. Standard Specifications for pre-molded expansion joint filler and expanded polystyrene joint filler.
  8. No admixtures will be allowed without prior approval of the Project Manager.
- D. Pavement Reinforcement Fabric: Pavement reinforcement fabric shall meet Caltrans Section 88-1.02, BP Petromat or approved equivalent.
- E. Crack Sealant:
1. Crack sealant shall be rubberized hot-pour type and shall meet ASTM D 3405, Husky 1611 or approved equivalent.
  2. Blotting Agent shall be one of: Screened sand, cement, or fly ash.
- F. Tack coat: Tack coat shall meet Caltrans Section 39-4.02.
- G. Pavement reinforcement mesh: Pavement reinforcement mesh for use in Type 2 Overlay shall be Glasgrid Model 8501 or approved equivalent.
- H. Structural geotextile fabric: Structural geotextile fabric shall be Mirafi 500X or approved equivalent.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Subgrade and Aggregate Base:
1. Prepare a subgrade and over excavation paragraph reference 3.4 of Section 31 00 00-EARTHWORK AND GRADING.
  2. Aggregate base shall be compacted to 95 percent ASTM D1557. Sections 26-1.04B and 26-1.05 of the C.D.T. Standard Specifications shall apply.
  3. Soil sterilant shall be applied to prepared subgrade or after installation of rock or aggregate base uniformly at the rate recommended by the manufacturer.
- B. Crack Sealing:
1. Before sealing, cracks shall be cleared of dirt, dust, and all other deleterious materials to a depth of ¼-inch to ½-inch.

2. Cracks 1/8-inch in width and greater shall be sealed.
3. Application of crack sealer shall be in accordance with the manufacturer's recommendations unless otherwise directed.

### **3.2 ASPHALT CONCRETE PAVING**

#### **A. General:**

1. Asphalt concrete shall be proportioned, mixed, placed, spread, and compacted in conformance with Section 39 of the C.D.T. Standard Specifications.
2. Before placing asphalt concrete on untreated base, a liquid asphalt prime coat shall be applied to the base course in conformance with Section 39 of the C.D.T. Standard Specifications. Prime coat shall be applied at the rate of 0.25 gallons per square yard.
3. Before placing asphalt concrete, an asphalt emulsion tack coat shall be applied to all vertical surfaces of existing pavement, curbs, gutters, construction joints, and all existing pavement to be surfaced, in conformance with Section 39 of the C.D.T. Standard Specifications.
4. Spreading and compacting asphalt concrete shall be performed in accordance with Section 39 of the C.D.T. Standard Specifications.
5. Fog seal shall be applied to all finished surfaces of asphalt concrete pavement at a rate of 0.05 gallons per square yard, in accordance with Section 37 of the C.D.T. Standard Specifications.
6. After fog seal has been applied, ample time shall be allowed for drying before traffic is allowed on the pavement or paint striping is applied.

### **3.3 CONCRETE CONSTRUCTION**

#### **A. General:**

1. All concrete shall be mixed in accordance with applicable provisions of Section 90 of the C.D.T. Standards Specifications.
2. Construction of concrete substructures shall conform to applicable provisions of Section 51 of the C.D.T. Standard Specifications. Unless noted otherwise in the Specifications, all exposed surfaces of structure shall have Class 1 surface finish or finished to match existing adjacent paving.
5. No pigment shall be used in curing compounds for construction of concrete curbs, gutters, and structures.
6. All work shall be subject to field inspection. No concrete shall be placed until the Project Manager has approved the forms and reinforcement.
7. Expansion joints on curbs and gutters shall be placed 20 feet on centers, adjacent to structures, and at all returns, and shall be filled with joint filler. Control joints shall be formed 10 feet on centers. The score shall 1-inch deep minimum.
8. Concrete shall not be dropped freely where reinforcing bars will cause segregation, nor shall it be dropped freely more than 6 feet. Spouts, elephant trunks, or other approved means shall be used to prevent segregation.

### **3.4 FIELD QUALITY CONTROL**

#### **A. Asphalt Concrete Paving:**

1. The specified thickness of the finished pavement shall be the minimum acceptable.
2. Conforms shall form a smooth, pond-free transition between existing and new pavement.
3. Depressions in paving between high spots are not to exceed 1/8-inch when measured below a 10 feet long straight edged placed anywhere on surface in any direction.
4. The finished asphalt pavement shall have positive drainage without ponding.

### **3.6 CLEANUP**

#### **A. General:**

1. Surplus material remaining upon completion of paving operations shall become the property of the Contractor, to be removed from the work site and disposed of in a lawful manner.

2. Surfaces shall be left in a clean, neat, and workmanlike condition, and all construction waste, rubbish, and debris shall be removed from the work site and disposed of in a lawful manner.

End of Document



**SECTION 32 31 00**

**FENCES AND GATES**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. Section Includes
  - 1. Galvanized steel chain link fabric fence.
  - 2. Privacy slats.
  - 3. Swing gates.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- C. Related Sections
  - 1. Section 05 50 00 - Metal Fabrications: Provision of gates and fencing not indicated to be chain link fabric type.
  - 2. Section 08 71 00 - Door Hardware: Provision of hardware for gate.

**1.02 REFERENCES**

- A. ASTM - American Society for Testing and Materials
  - 1. A90 - Standard Test Method for Weight of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
  - 2. A641 - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
  - 3. C33 - Standard Specification for Concrete Aggregates.
  - 4. C150 - Standard Specification for Portland Cement.
  - 5. C387 - Standard Specification for Packaged, Dry, Combined Materials for Mortar and Concrete.
  - 6. F626 - Standard Specification for Fence Fittings.
  - 7. F668 - Standard Specification for Polyvinyl Chloride (PVC) and Other Organic Polymer-Coated Steel Chain-Link Fence Fabric.
  - 8. F900 - Standard Specification for Industrial and Commercial Swing Gates.
  - 9. F1083 - Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.
- B. CLFMI - Chain Link Fence Manufacturers Institute
  - 1. Product Manual.

**PART 2 - PRODUCTS**

**2.01 MANUFACTURERS**

- A. Acceptable Manufacturer: Anchor Fence Co. Inc.; Security Fence Manufacturing & Supply Co., Inc., or equal.

**2.02 CHAIN LINK FENCE**

- A. Fabric
  - 1. Selvage: Knuckled on both selvages.
  - 2. Steel Chain-Link Fence Fabric: Fabricated in 1 piece widths for fencing 12 feet and less in height to comply with CLFMI's "Product Manual" and with requirements indicated below:

- a. Mesh and Wire Size: Match existing fencing adjacent.
- b. Coating: ASTM F668, Class 1, PVC, thermally fused.

B. Framing

1. Type I Round Posts: Standard weight (schedule 40) galvanized steel pipe conforming to ASTM F1083, with minimum yield strength of 25,000 psi, not less than 1.8 ounce of zinc per square foot. Type A coating inside and outside, as determined by ASTM A90, and weights per foot as follows:

<u>Actual OD</u>	<u>Weight (lb/ft)</u>	<u>NPS Size</u>
1.315	1.68	1
1.660	2.27	1-1/4
1.900	2.72	1-1/2
2.375	3.65	2
2.875	5.79	2-1/2
3.500	7.58	3
4.000	9.11	3-1/2
6.625	8.97	6
8.625	28.55	8

2. Top and Bottom Rail: Manufacturer's longest lengths (17 to 21 feet) with swaged-end or expansion -type coupling, approximately 6 inches long for joining. Provide rail ends or other means for attaching top rail securely to each gate corner, pull and end post.
  - a. Round Steel: 1.660 inch OD Type I steel pipe.
3. Steel Posts for Fabric Heights Up to 6 Feet High
  - a. Round End, Corner and Pull Posts: 2.375 inch OD Type I steel pipe.
4. Steel Posts for Fabric Heights Over 6 Feet High
  - a. Round End, Corner and Pull Posts: 2.875 inch OD Type I steel pipe.
5. Swing Gate Posts: Furnish posts to support single gate leaf, or one leaf of a double gate installation, according to ASTM F900, sized as follows for steel pipe posts.
  - a. Steel Posts for Fabric Height of 6 feet or Less and Gate Leaf Width:
    - 1) Up to and Including 4 Feet: 2.375 inch OD pipe weighing at least 3.11 pounds per foot.
    - 2) Over 4 Feet to 10 Feet: 2.875 inch OD pipe weighing at least 4.64 pounds per foot.
  - b. Steel Posts for Fabric Height Over 6 feet and Gate Leaf Width:
    - 1) Up to and Including 6 Feet: 2.875 inch OD pipe weighing at least 4.64 pounds per foot.
    - 2) Over 6 Feet to 12 Feet: 4.000 inch OD pipe weighing at least 8.65 pounds per foot.

C. Fittings and Accessories

1. Material: Comply with ASTM F626. Mill-finished galvanized iron or steel to suit manufacturer's standards.
  - a. Unless specified otherwise, hot-dip galvanize pressed steel or cast-iron fence fittings and accessories with at least 1.2 oz. zinc per sq. ft. as determined by ASTM A90.
2. Post and Line Caps: Provide weathertight closure cap for each post.
3. Bottom and Center Rail: Same material as top rail. Provide manufacturer's standard galvanized steel cap for each end.
4. Tension or Stretcher Bars: Hot-dip galvanized steel with a minimum length 2 inches less than the full height of fabric, a minimum cross section of 3/16-inch by 3/4-inch, and a minimum of 1.2 oz. of zinc coating per sq. ft. Provide 1 bar for each gate and end post, and 2 for each corner and pull post, except where fabric is integrally woven into the post.

5. Tension and Brace Bands: 3/4-inch wide minimum hot-dip galvanized steel with a minimum of 1.2 oz. of zinc coating per sq. ft.
    - a. Tension Bands: 0.074-inch thick (14 gauge) minimum.
    - b. Brace Bands: 0.105-inch thick (12 gauge) minimum.
  6. Tie Wires: 0.106-inch diameter (12 gauge) galvanized steel with a minimum of 0.80 ounce per square foot of zinc coating according to ASTM A641, Class 3 to match fabric wire.
- A. Privacy Slats: Polyvinyl chloride (PVC), UV-light stabilized, thickness and size to match existing fencing adjacent.
1. Color: Gray to match existing fencing adjacent.

### **2.03 SWING GATES**

- A. Comply with ASTM F900.
1. Steel Gate Up to 8 Feet Wide and Up to 6 Feet High: Fabricate perimeter frames of 1.660 inch minimum OD Type I steel pipe.
  2. Finish: As selected by the Architect.
- B. Gate Hardware: Refer to Section 08 71 00.
1. Hinges: Non-liftoff type, offset to permit 180 degree gate opening.
  2. Latch: Forked type or plunger bar type with padlock eye.
  3. Keeper: Provide a keeper for vehicle gates that automatically engages gate leaf and holds it in open position until manually released.
  4. Gate Stops: For double gates, provide gate stops set in concrete, designed to engage a center drop rod or plunger bar. Include a locking device permitting both gate leaves to be locked with a single padlock.

### **2.04 CONCRETE**

- A. Concrete: Provide concrete consisting of portland cement in accordance with ASTM C150, aggregates in accordance with ASTM C33, and potable water. Mix materials to obtain concrete with a minimum 28-day compressive strength of 3,000 psi. Use at least 4 sacks of cement per cubic yard, 1 inch maximum size aggregate, 3 inch maximum slump.
- B. Packaged Concrete Mix: Mix dry-packaged normal-weight concrete conforming to ASTM C387 with clean water to obtain a 2 to 3 inch slump.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION, GENERAL**

- A. General
1. Install fences in accordance with reviewed shop drawings and manufacturer's installation instructions.
  2. Do not begin installation and erection before final grading is completed, unless otherwise permitted.
  3. Install fencing plumb, taut, and true to line and ground contour. Install fencing to the height and construction as indicated on the Drawings.
  4. Install gate plumb, level, and secure for full opening without interference. Adjust hardware for smooth operation and lubricate where necessary.
- B. Excavation: Drill or hand-excavate (using post-hole digger) holes for posts to diameters and spacings indicated, in firm, undisturbed or compacted soil.

1. If not indicated on the Drawings, excavate holes for each post to minimum diameter recommended by fence manufacturer, but not less than 4 times the largest cross section of post.
  2. Unless otherwise indicated, excavate hole depths approximately 3 inches lower than post bottom, with bottom of posts set not less than 36 inches below finish grade surface.
- C. Setting Posts: Center and align posts in holes 3 inches above bottom of excavation. Space a maximum of 10 feet on center unless otherwise indicated.
1. Protect portion of posts above ground from concrete splatter. Place concrete around posts and vibrate or tamp for consolidation. Check each post for vertical and top alignment, and hold in position during placement and finishing operations.
    - a. Unless otherwise indicated, extend concrete footings 2 inches above grade and trowel to a crown to shed water.

### **3.02 INSTALLATION, FENCES AND GATES**

- A. Chain Link Fence
1. Top Rails: Run rail continuously through line post caps, bending to radius for curved runs and at other posts terminating into rail end attached to posts or post caps fabricated to receive rail. Provide expansion couplings as recommended by fencing manufacturer.
  2. Center Rails: Install center rails in 1 piece between posts and flush with post on fabric side, using rail ends and special offset fittings where necessary.
  3. Brace Assemblies: Install braces at end posts and at both sides of corner and pull posts. Locate horizontal braces at mid height of fabric on fences with top rail. Install so posts are plumb when diagonal rod is under proper tension.
  4. Fabric: Pull fabric taut and tie to posts, rails, and tension wires. Install fabric on security side of fence, and anchor to framework so that fabric remains under tension after pulling force is released.
  5. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not over 15 inches on center.
  6. Tie Wires: Use wire of proper length to secure fabric firmly to posts and rails. Bend ends of wire to minimize hazard to persons or clothing.
    - a. Maximum Spacing: Tie fabric to line posts 12 inches on center and to rails and braces 24 inches on center.
  7. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts for added security.
- B. Gates: Install in accordance with manufacturer's instructions.
- C. Privacy Slats: Install slats to match pattern and direction of existing fencing adjacent, securely locked in place.

### **3.03 ADJUSTING**

- A. Gates: After repeated operation of completed installation equivalent to 3 day of use by normal traffic, readjust gates for optimum operating condition and safety. Lubricate operating equipment and clean exposed surfaces.

**END OF SECTION**



## **Section 33 40 00 STORM DRAINAGE**

### **PART 1 – GENERAL**

#### **1.1 SUMMARY**

- A. This section describes general requirements, products, and methods of execution relating to on-site storm drainage excluding portions within five feet of buildings unless otherwise noted. Any work within the public right-of-way shall be constructed to the standards of the City of San Mateo; State of California Department of Transportation.
  - 1. Storm drain piping.
  - 2. Storm drain structures including curb inlets, catch basins, area drains, and manholes.
  - 3. Storm drain outfalls.
  - 4. Culverts and headwalls.
  - 5. Storm drain pump station.
- B. Contractor shall provide all labor, equipment, and materials, unless otherwise noted.
- C. Related Sections:
  - 1. Section 02315 – TRENCHING, BACKFILLING, AND COMPACTING.

#### **1.2 SUBMITTALS**

- A. Comply with the requirements of Section 01330 – SUBMITTAL PROCEDURES.
- B. Product Data: Manufacturer's literature and data, including, where applicable, pressure rating, capacity, labels, or other markings on equipment made to the specified standards for materials, for the following:
  - 1. Piping and fittings.
  - 2. Jointing material.
  - 3. Gaskets, couplings, and sleeves.
  - 4. Precast concrete structures, including manholes and drainage inlets.
  - 5. Concrete mix design for precast and cast-in-place structures.
  - 6. Manhole lids and frames.
  - 7. Manhole steps.
  - 8. Pipe to Structure Connection Seal
  - 9. Drainage inlet and area drain grates and frames.
  - 10. Pump station vaults.
  - 11. Pump data.

#### **1.3 QUALITY ASSURANCE**

- A. Comply with the latest editions of the following Standards and Regulations:
  - 1. American Society for Testing and Materials (ASTM).
    - a. A74: Cast Iron Soil Pipe and Fittings.
    - b. A615: Deformed and Plain Billet-Steel Bars for Reinforcement.
    - c. B32: Solder Metal.
    - d. C76: Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

- e. C150: Portland Cement.
- f. C478: Precast Reinforced Concrete Manhole Sections.
- g. C494: Chemical Admixtures for Concrete.
- h. C920-02: Elastomeric Joint Sealants.
- i. D2241-00: Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
- j. D2680-01 Acrlonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Piping.
- k. D2729: Perforated PVC Drain Pipe.
- l. D3034-00: Type PSM Polyvinyl Chloride (PVC) Sewer pipe and Fittings.
- m. F1336-02: Poly(Vinyl Chloride) (PVC) Gasketed Sewer Fittings.
- 2. California Department of Transportation (CDT): Standard Specifications:
  - a. Section 51: Concrete Structures
  - b. Section 52: Reinforcement
  - c. Section 55: Steel Structures
  - d. Section 66: Corrugated Facilities
  - e. Section 70: Miscellaneous Metal
  - f. Section 72: Slope Protection
  - g. Section 75: Miscellaneous Metal
  - h. Section 90: Portland Cement Concrete
- 3. City of San Mateo Standard Plans and Specifications.
- 4. American Association of State Highway and Transportation Officials (AASHTO) for H20 Loading.
- 5. American Concrete Institute (ACI).
- 6. Other authorities having jurisdiction.

- B. System Description: Grades and elevations are to be established with reference to the benchmarks referenced on the Plans.

## **PART 2 – PRODUCTS**

### **2.1 PIPING**

- A. Polyvinyl Chloride (PVC) Pipe: PVC pipe conforming to ASTM D3034, SDR 35 with bell-and-spigot type of rubber gasket joints. Bells shall be integral with pipe. Spigot end pipe with separate double hub couplings is not acceptable.
- B. Reinforced Concrete Pipe (RCP): RCP shall conform to ASTM C76 with tongue-and-groove or bell-and-spigot joints. Unless indicated otherwise on the plans, all reinforced concrete pipe shall be Class III, 1350-D pipe.
- C. High-Density Polyethylene (HDPE) Pipe: HDPE Pipe is NOT an acceptable product, and will not be considered for product substitution.

### **2.2 MANHOLES**

- A. Manholes shall be pre-cast concrete of the size and shape shown on the Drawings and shall conform to Sections 70-1.02H of the CDT Standard Specifications and to ASTM C478. Equivalent poured-in-place structures may be used at the Contractor's option. Concrete shall consist of Caltrans Type I/II cement.
- B. Frames and covers shall be cast iron conforming to Section 55-2.03 and 75-1.02 of the CDT Standard Specifications. Manhole covers shall have the words "STORM DRAIN" in letters not less than 2-inches cast into the cover. The clear opening for all manhole covers shall be 24 inches.

- C. All interior concrete surfaces shall be coated with “Xypex Crystalline” or equal. Use of a water-resistant admix is acceptable, at Contractor option.
- D. Frames and grates for manholes and catch basins shall be match-marked in pairs before delivery to the job site. The grates shall fit into their frames without rocking. Grates shall have a maximum opening of one-half inch between bars, unless otherwise noted in the Plans.
- E. Reinforcing Bars: Reinforcing bars shall be of intermediate grade billet steel conforming to ASTM A615 and shall be of the size shown on the Standard Details or in the Drawings. Bars shall be of the round deformed type, free from injurious seams, flaws, or cracks, and shall be cleaned of all rust, dirt, grease and loose scales.
- F. Portland Cement Concrete: Concrete for manhole bases, inlets, and other concrete structures shall conform to the requirements of CDT Section 90 and as herein specified. The concrete shall be Class “2” containing at least six (6) sacks of Portland Cement per cubic yard of concrete. The grading of the combined aggregate shall conform with the CDT requirements of the three-quarter inch maximum. The consistency of the fresh aggregate shall be such that the slump does not exceed four inches, as determined by Test Method No. Calif. 520. The concrete shall have a minimum design compressive strength of 3,000 psi after 28 days.

### **2.3 PIPE TO STRUCTURE CONNECTOR/SEAL**

- A. A flexible pipe to manhole connector shall be used for all pipe penetrations and/or cast-in-place concrete structures.
  - 1. The seal shall provide a flexible, positive, watertight connection between pipe and concrete wastewater structures. The connector shall assure that a seal is made between (1) the connector and the structure wall, and (2) between the connector and the pipe. The seal between the connector and the manhole wall shall be made by casting the connector integrally with the structure wall during the manufacturing process in such a manner that it will not pull out during coupling. The seal between connector and pipe will be made by way of a stainless steel take down band compressing the gasket against the outside diameter of the pipe.
    - a. The connector shall be molded from materials whose physical/chemical properties meet or exceed the physical/chemical resistant properties outlined in ASTM C-923. The connector and stainless steel hardware shall meet or exceed the performance requirements proscribed in ASTM C-923.
    - b. The connector shall be of size specifically designed for the pipe material being used and shall be installed in accordance with recommendations of the manufacturer.
  - 2. Connectors shall be Z-LOK or G3 connectors manufactured by A-LOK Products Inc. or approved equivalent.

### **2.4 AREA DRAINS**

- A. Grate and Riser: Area drain shall be ADS model 2718 AG or approved equal. Riser shall be constructed of 6-inch PVC SDR 35 piping per paragraph 2.1(A) of this section and connected to area drain by a gasket joint. Riser shall be vertical except as otherwise noted in the plans. Riser may include a reducer if necessary to make connection to the storm drain line.

- B. Elevation and Grading: Area Drain rim elevation shall be set and area around area drain shall be graded to drain away from any adjacent structures, walks, or roadways and towards area drain.

## **2.5 CLEAN-OUTS**

- A. A valve box shall be provided for each clean-out. Boxes shall be pre-cast concrete with cast iron frame and cover marked "STORM DRAIN"; Christy G5 with G5C lid or approved equivalent.

## **2.6 CULVERT AND OUTFALL HEADWALLS**

- A. All headwalls shall be constructed in conformance with CDT Standard Plans as indicated.

## **PART 3 – EXECUTION**

### **3.1 PIPE INSTALLATION**

- A. Pipe shall be installed in conformance with Section 02315, and manufacturer's recommendations.
- B. Pipe laying:
  - 1. No pipe shall be laid until the Geotechnical Engineer inspects and approves the conditions of the bottom of the trench.
  - 2. Pipe laying shall proceed "up grade" with the spigot section of the bell-and-spigot pipe pointing in the direction of the flow.
  - 3. Each section of pipe shall be laid true to line and grade and in such a manner as to form an close concentric joint with the adjoining pipe and to prevent sudden offsets in the flow line.
  - 4. Pipe shall not be laid when the condition of the trench or the weather is unsuitable.
- C. Debris Control:
  - 1. The interior of the storm pipe shall be kept clean of dirt and debris at all times. When work is not in progress, open ends of pipe and fittings shall be plugged.
  - 2. Where clearing after laying is difficult because of small pipe size, a suitable swab or squeegee shall be kept in the pipe and pulled forward past every joint immediately after joining has been completed.

### **3.2 POURED-IN-PLACE CONCRETE**

- A. Concrete shall be mixed in accordance with applicable provisions of Section 90 of the CDT Standard Specifications. Concrete shall consist of Type I/II cement.
- B. Construction of concrete structures shall conform to applicable provisions of Section 51 of the CDT Standards Specifications. Unless otherwise noted herein or in the Drawings, exposed surfaces of structures shall be Class 1 surface finish.
- C. Curing shall conform to applicable portions in Section 90 of CDT Standard Specifications. No pigment shall be used in curing compounds. All work shall be subject to inspection. No concrete shall be placed until the Project Manager has approved the forms and reinforcement.

- D. Concrete shall not be dropped freely where reinforcing bars will cause segregation, nor shall it be dropped freely more than six feet. Spouts, elephant trunks, or other approved means shall be used to prevent segregation.

### 3.3 PIPELINE FLUSHING

- A. Newly constructed storm drain pipes shall be flushed with water to clean. A metal screen shall be used to collect and remove any rock, silt and other debris that is flushed out during cleaning.

### 3.4 DEFLECTION TESTING

- A. Upon completion of work, perform a deflection test on entire length of installed plastic pipeline. Completed work includes superimposed loads adjacent to and over the pipeline, such as compacted backfill and earthwork, and does not include paving, concrete curbs and gutters, sidewalks, walkways, and landscaping.
- B. Under external loads, deflection of pipe in the installed pipeline shall not exceed 4.5 percent of the average inside diameter of pipe.
- C. Determine whether the allowable deflection has been exceeded by use of a pull-through device or a deflection-measuring device.
- D. Pull-Through Device:
  - 1. Provide a spherical, spheroidal, or elliptical ball, a cylinder, or circular sections fused to a common shaft.
    - a. Circular sections shall be so spaced on the shaft that distance from external faces of front and back sections will equal or exceed diameter of the circular section.
    - b. Pull-through device may also be of a design approved by the Uni-Bell Plastic Pipe Association, provided that the device meets the applicable requirements specified in this paragraph, including those for diameter of the device.
  - 2. Ball, cylinder, or circular sections shall conform to the following:
    - a. A diameter, or minor diameter as applicable, of 95 percent of the average inside diameter of the pipe; tolerance of plus 0.5 percent will be permitted.
    - b. A homogeneous material throughout, with a density greater than 1.0 as related to water at 39.2 degrees F, and a surface Brinell hardness of not less than 150.
    - c. Center bored and through bolted with a ¼ inch minimum diameter steel shaft having a yield strength of not less than 70,000 pounds per square inch, with eyes or loops at each end for attaching pulling cables.
    - d. Each eye or loop shall be suitably backed with a flange or heavy washer such that a pull exerted on opposite end of shaft will produce compression throughout remote end.
  - 3. Pull-Through Device:
    - a. Pass the pull-through device through each run of pipe, either by pulling it through or flushing it through with water.
    - b. If the device fails to pass freely through a pipe run, replace pipe which has the excessive deflection and completely retest in same manner and under same conditions as specified.
- E. Deflection measuring Device:

1. Sensitive to 1.0 percent of the diameter of the pipe being tested and accurate to 1.0 percent of the indicated dimension.
2. Obtain approval of deflection measuring device prior to use.

F. Deflection Measuring Device Procedure:

1. Measure deflections through each run of installed pipe.
2. If deflection readings in excess of 4.5 percent of average inside diameter of pipe are obtained, retest pipe by a run from the opposite direction.
3. If retest continues to show a deflection in excess of 4.5 percent of average inside diameter of pipe, remove pipe which has excessive deflections, replace with new pipe, and completely retest in same manner and under same conditions.

G. Warranty Period Test: Pipe found to have a deflection of greater than 5 percent of average inside diameter when deflection test is performed just prior to end of 1 year warranty period shall be replaced with new pipe and tested as specified for leakage and deflection.

### 3.5 CLEANING

- A. Thoroughly clean storm drain lines, manholes, catch basins, field inlets, culverts, and similar structures, of dirt, debris, and obstructions of any kind.

### 3.6 TELEVISION INSPECTION

- A. After completion of the pipe installation, service connections, flushing and cleaning, and prior to placement of pavement, the storm drainage line shall be televised with a color closed-circuit television with tilt-head camera recorded in VHS format. The original videotape and log sheets shall be provided to the District.
1. The following observations from television inspections will be considered defects in the construction of sewer pipelines and will require correction prior to placement of pavement:
    - a. Low spot (1 inch or greater - mainlines only).
    - b. Joint separations (3/4 inch or greater opening between pipe sections).
    - c. Cocked joints present in straight runs or on the wrong side of pipe curves.
    - d. Chips in pipe ends.
    - e. Cracked or damaged pipe.
    - f. Dropped joints.
    - g. Infiltration.
    - h. Debris or other foreign objects.
    - i. Other obvious deficiencies.
    - j. Irregular condition without logical explanation.

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