

*Project Manual*

VOLUME 3 OF 3

***CSM CIP2 BUILDING 5N PROJECT  
COLLEGE OF SAN MATEO***

San Mateo, CA

AS-BUILT SPECIFICATIONS

May 11, 2010

Developed for:  
College of San Mateo  
San Mateo, CA





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VOLUME 3 OF 3

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San Mateo, CA





**- SECTION 00005 -**

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## **- SECTION 10 1116 -**

# **VISUAL DISPLAY BOARDS**

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## **PART 1 - GENERAL**

### **1.1 RELATED DOCUMENTS**

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

### **1.2 SUMMARY**

- A. This Section includes the following:
  - 1. Markerboards.
  - 2. Tackboards.
  - 3. Sliding visual display units.
- B. Design Requirements: Provide concealed fastening wherever possible.
- C. Fire Resistance Requirements:
  - 1. Test method: ASTM E84.
  - 2. Flame spread index: 25 or less.
  - 3. Smoke developed index: 0 to 450.

### **1.3 DEFINITIONS**

- A. Tackboard: Framed or unframed, tackable, visual display board assembly.
- B. Visual Display Board Assembly: Visual display surface that is factory fabricated into composite panel form, either with or without a perimeter frame; includes markerboards, and tackboards.
- C. Visual Display Surface: Surfaces that are used to convey information visually, including surfaces of markerboards, tackboards, and surfacing materials that are not fabricated into composite panel form but are applied directly to walls.

### **1.4 RELATED SECTIONS**

- A. Section 01 81 13 "LEED Certification Requirements".
- B. Section 06 1053 "Miscellaneous Rough Carpentry" to provide misc blocking for visual display boards.



## 1.5 SUBMITTALS

- A. General: Submit in accordance with Section 01 3219.
- B. LEED Submittals: See Section 018113 LEED Certification Requirements for the following:
  - 1. Product Data for Credit EQ 4.4: For composite wood products, documentation indicating that the product contains no urea formaldehyde.
  - 2. Product Data for Credit EQ 4.1: For adhesives, including printed statement of VOC content and chemical components.
  - 3. MRc4 Recycled Content: Product data for products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content.
    - a. Include cost information for each product having recycled content.
  - 4. MRc5 Regional Materials:
    - a. Sourcing location(s): indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery from the project site.
    - b. Manufacturing location(s): indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
    - c. Product Value: indicate dollar value of product containing regional materials; include materials costs only.
    - d. Product Component(s) Value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.
- C. Product Data:
  - 1. Submit manufacturer's descriptive literature and product specifications for each product.
  - 2. Include information for factory finishes, accessories, and other required components.
  - 3. Include color charts for finish indicating manufacturer's full range of colors available for selection.
- D. Samples for Verification: For each type of visual display surface indicated and as follows:
  - 1. Visual Display Surface: Not less than **8-1/2 by 11 inches (215 by 280 mm)**, mounted on substrate indicated for final Work. Include one panel for each type, color, and texture required.
  - 2. Trim: **6-inch- (152-mm-)** long sections of each trim profile.
  - 3. Support System: **6-inch- (152-mm-)** long sections.
  - 4. Fabric swatches of vinyl and polyester fabric-faced tack assemblies.
- E. Closeout Submittals:
  - 1. Operation and Maintenance Data: Submit manufacturer's printed, recommended regular cleaning instructions, stain removal instructions, and surface break-in instructions for markerboards.
  - 2. Warranty: Submit specified warranty in accordance with Section 01 7700.

**1.6 QUALITY ASSURANCE**

- A. Single Source Responsibility:
  - 1. Furnish products from one manufacturer for entire Project, unless otherwise acceptable to Architect.
  - 2. Provide each markerboard and tackboard as complete unit, including trim and accessory items necessary for proper function.
- B. Deliver factory-built visual display surfaces, including factory-applied trim where indicated, completely assembled in one piece without joints, where possible. If dimensions exceed maximum manufactured panel size, refer to drawings for joint location. When overall dimensions require delivery in separate units, prefit components at the factory, disassemble for delivery, and make final joints at the site.
- C. Manufacturer Qualifications: Company specializing in manufacturing Products specified in this Section with minimum 5 years documented experience.
- D. Certifications:
  - 1. Submit manufacturer's certification that products furnished for Project meet or exceed specified requirements.
  - 2. Submit Contractor's certification that products are installed in accordance with Contract Documents.

**1.7 SEQUENCING**

- A. Ensure finishes, including painting, are completed and accepted prior to installation of work of this Section.

**1.8 WARRANTY**

- A. Comply with provisions of Section 01 7700.
- B. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer's standard form in which manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Surfaces lose original writing and erasing qualities.
    - b. Surfaces exhibit crazing, cracking, or flaking.
  - 2. Warranty Period: Life of the building.

**PART 2 - PRODUCTS****2.1 MANUFACTURERS:**

- A. Acceptable Manufacturers:
  - 1. PolyVision Corporation.

## 2.2 MATERIALS, GENERAL

- A. Porcelain-Enamel Face Sheet: Manufacturer's standard steel sheet with porcelain-enamel coating fused to steel; uncoated thickness indicated.
  - 1. Gloss Finish: Gloss as indicated; dry-erase markers wipe clean with dry cloth or standard eraser.
- B. Melamine: Thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.
- C. Hardboard: AHA A135.4, tempered.
- D. Particleboard: ANSI A208.1, Grade 1-M-1.
- E. Fiberboard: ANSI A208.2, Grade MD.
- F. Natural Cork Sheet: Seamless, single layer, compressed fine-grain cork sheet, bulletin board quality; face sanded for natural finish.
- G. Extruded Aluminum: **ASTM B 221 (ASTM B 221M)**, Alloy 6063.
- H. High-Pressure Plastic Laminate: NEMA LD 3.

## 2.3 PORCELAIN STEEL MARKERBOARD

- A. Materials:
  - 1. Enameling Sheet Steel Options:
    - a. Comply with ASTM A424, Type 1, commercial quality.
    - b. Aluminized stretcher-leveled sheet steel.
  - 2. Hardboard: Comply with AHA A135.4, tempered, smooth face.
  - 3. Particleboard: Comply with NPA A208.1, set with waterproof resin binder, sanded faces.
- B. Panel Construction:
  - 1. Face Sheet: Porcelain finish on 24 gage enameling sheet steel.
  - 2. Core: 1/4 inch thick hardboard or 3/8 inch particleboard.
  - 3. Backing Sheet: 0.015 inch aluminum foil.
- C. Fabrication:
  - 1. Pressure laminate face sheet and backing sheet to core using manufacturer's moisture-resistant thermoplastic adhesive.
  - 2. Fabricate as fixed panels.
  - 3. Fabricate units completely assembled in one piece without joints, unless manufacturer's maximum dimensions are exceeded.
  - 4. When Manufacturer's Maximum Dimensions are Exceeded:
    - a. Fabricate in minimum quantity of pieces and joints.
    - b. Fabricate units from equal size pieces, balanced around center of unit.
    - c. Factory pre-assemble and pre-fit components.
    - d. Disassemble for delivery ready for re-assembly at site.

## VISUAL DISPLAY BOARDS

- e. Do not place seams at centerline of entire unit.
- f. Provide with spline-connected butt joint to produce a non-lipped joint between adjoining porcelain steel panels.

D. Porcelain finish:

- 1. Porcelain enamel, vitreous surface fused to steel substrate.
- 2. Surface Texture: Writing surface cover coat with high gloss finish intended for use with dry-wipe-off liquid felt-tipped markers.
- 3. Color: White.

## 2.4 SLIDING VISUAL DISPLAY UNITS

- A. Horizontal-Sliding Visual Display Units: Factory-fabricated units consisting of extruded-aluminum tubular frame, sliding rear visual display panel, aluminum-framed horizontal-sliding panels, and extruded-aluminum fascia that conceals overhead sliding track; designed for recessed mounting. Provide panels that operate smoothly without vibration or chatter.
- 1. Manufacturers:
    - a. Claridge.
    - b. PolyVision Corporation.
    - c. Or equal.
  - 2. Two-Track Units: Fabricate unit with fixed rear panel covering entire rear surface. Provide two sliding panels, each equal to not less than one-half of overall length of unit.
  - 3. Sliding Panels: Fabricated from not less than **3/8-inch- (9.5-mm-)** thick, kraft-paper honeycomb core; designed to be rigid and to resist warpage.
  - 4. Hardware: Manufacturer's standard extruded-aluminum overhead track and channel-shaped bottom guides; with two nylon ball-bearing carriers and two nylon rollers for each sliding panel.

## 2.5 TACKBOARD ASSEMBLIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 1. ADP Lemco, Inc.
  - 2. Claridge Products and Equipment, Inc.
  - 3. Egan Visual Inc.
  - 4. PolyVision Corporation; a Steelcase company.
- B. Natural-Cork Tackboard: **1/4-inch- (6-mm-)** thick, natural cork sheet factory laminated to **1/4-inch- (6-mm-)** thick fiberboard backing.

## 2.6 MARKERBOARD AND TACKBOARD ACCESSORIES

- A. Aluminum Frames and Trim: Fabricated from not less than **0.062-inch- (1.57-mm-)** thick, extruded aluminum; of size and shape indicated.
- 1. Field-Applied Trim: Manufacturer's standard snap-on trim with no visible screws or exposed joints.
  - 2. Factory-Applied Trim: Manufacturer's standard.

- B. Chalktray: Manufacturer's standard, continuous.
  - 1. Solid Type: Extruded aluminum with ribbed section and smoothly curved exposed ends.
  - 2. End Stops: Located at each end of chalktray.
- C. Map Rail: Provide the following accessories:
  - 1. Display Rail: Continuous and integral with map rail; fabricated from cork approximately 1 to 2 inches (25 to 50 mm) wide.
  - 2. End Stops: Located at each end of map rail.
- D. Temporary Protective Cover: Polyethylene sheet, 8 mil thick.

## 2.7 FABRICATION

- A. Porcelain-Enamel Visual Display Assemblies: Laminate porcelain-enamel face sheet and backing sheet to core material under heat and pressure with manufacturer's standard flexible, waterproof adhesive.
- B. Visual Display Boards: Factory assembled visual display boards, unless otherwise indicated.
  - 1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display boards at manufacturer's factory before shipment.
- C. Aluminum Frames and Trim: Fabricate units straight and of single lengths, keeping joints to a minimum. Miter corners to neat, hairline closure.
- D. Trim and chalk trays shall be assembled and attached to visual display units at manufacturer's factory before shipment

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine conditions and proceed with work when substrates are ready.
- B. Verify that internal wall blocking is ready to receive units and positioning dimensions are as required by manufacturer.
- C. Verify before installation that interior moisture and temperature approximate normal occupied conditions.

### 3.2 INSTALLATION, GENERAL

- A. Install in accordance with manufacturer's instructions and approved shop drawings.
  - 1. Provide shims for solid undistorted surfaces.
  - 2. Install units plumb, level, square, and free from warp or twist while maintaining dimensional tolerances and alignment with surrounding construction.
  - 3. Install units flush with wall surfaces, level and square, and with flush smooth joints.
  - 4. Butt panels tight with concealed spline to hairline joint.

## VISUAL DISPLAY BOARDS

- 5. Trim:
  - a. Miter at corners and fit closely to provide hairline joints.
  - b. Dress to remove burrs and sharp edges.
  - c. Steel Stud Walls: Secure with countersunk oval head self-tapping screws at each intersection with steel stud.
  - d. Match screw head finish to trim color.
  
- B. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation

**3.3 ADJUST & CLEANING**

- A. Verify that all accessories are installed as required, and adjusted to operate smoothly for each unit.
- B. Clean as required by manufacturer. Do not use materials or methods which may damage finish and surrounding construction.
- C. Cover board surfaces with protective cover, taped to frame.
- D. Remove protective cover at date of Substantial Completion.

**3.4 PROTECTION**

- A. Protect finished work.
- B. Protect finished work from damage or defacement and replace defective units as directed by Architect prior to final completion and acceptance of project at no additional cost to Owner.

**- END OF SECTION -**



## **- SECTION 10 1400 -**

# **SIGNAGE**

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### **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 SCOPE OF WORK**

- A. Review of Construction Drawings: Bidders shall, as a part of their bid, call specific attention to any construction details, materials, methods of fabrication or other similar items which they consider to be impractical or not in keeping with good industry practice. Requests for change orders for substitutions to address such items after award of contract shall not be accepted.
- B. Quantities/Unit Process: the bid quantity for each Sign Type shall be based on the Sign Schedule. The Contract shall establish unit costs based on these quantities, and the bid shall consist of extensions of these unit costs. The contract shall be adjusted as necessary, using these unit costs, for additions or deletions within ten percent of the base bid quantity for each Sign Type.
- C. Allowance for Submittals: Allow for thorough and complete preparation of all submittal items described at Section 1.05, for delivery and/or shipping of same, and for resubmittal(s) as required until approval has been obtained for all items.

#### **1.3 RELATED SECTIONS**

- A. The General Conditions, Supplemental Conditions and Division 1 – General Requirements are hereby made a part of this Section as fully as if repeated herein.

#### **1.4 STRUCTURAL DESIGN AND ENGINEERING**

- A. Details in the Drawings indicate a general design approach for sign structures but do not necessarily include the specific fabrication details required for the complete structural integrity of the signs, nor do they necessarily consider preferred shop practices of individual contractors. Such specific fabrication details shall be provided by the Contractor, who shall ensure that all signs withstand any and all static, dynamic and/or erection loads that act upon them, including all such loads associated with handling, erecting, and servicing.



- B. Contractor shall furnish a complete structural design for each and every sign type, incorporating all reasonable safety factors necessary to protect the Owner and Contractor against public liability.
  - 1. All such structural designs shall meet applicable local, state, and national codes, as well as testing laboratory listings, where required.
- C. Contractor shall be responsible for the engineering and internal construction of all signs, and shall submit shop drawings and details for review by the Architect. Shop drawings for Sign Types (tbd, if applicable) shall be designed and stamped by a licensed Engineer currently registered in the State of California. Said stamped shop drawings shall specify all structural components and methods required to withstand the design wind load and design seismic load at the location of the sign(s).
  - 1. All structural design shall meet applicable local, state, and national codes, as well as testing laboratory listings, where required.

### 1.5 SUBMITTALS

- A. Presubmittal Conference: Coordinate with the Architect prior to preparation of submittals to confirm submittal requirements and schedule.
- B. Product Data: If requested by Architect, submit manufacturers' catalog sheets, brochures, diagrams, schedules, charts, illustrations, test results and/or other standard descriptive data.
  - 1. Mark up each copy to identify pertinent materials, products or models.
  - 2. Show dimensions and clearances required, performance characteristics and capacities, and wiring diagrams and/or controls as apply.
- C. Code Compliance: All signage shall comply with California Building Code Sections 1114B, 1115B.5, 1117B.5 and CBC 1011.
- D. Shop Drawings:
  - 1. All shop drawings shall be neat, well organized and clearly legible. All shop drawings shall be drawn to conventional scale and not subsequently reduced to fit a drawing format.
  - 2. Submit elevations and plan views for all sign types, including graphic layouts, complete dimensions, materials, locations of all exposed fasteners, colors and finishes. Determine the total quantity for each sign type and note it in the shop drawings.
  - 3. Submit comprehensive section drawings for sign types where applicable, including sections of all typical members. Show fabrication and installation details, including details for securing members to one another, to building structures, and/or to site work. Show interior construction, reinforcements, anchorages, components and finishes.
  - 4. Site Condition Verification: Where required by the Architect for specific items, Contractor shall inspect site to confirm installation conditions, then submit shop drawings and/or written documentation for approval indicating proposed mounting devices.
- E. Samples:
  - 1. Color and Finish: Submit 3 each, 6 inch x 6 inch samples of all paint colors, screen ink colors, vinyl colors, and material finishes. All paint and screen inks are to be applied to the appropriate substrate.
    - a. Contractor to submit verification of paint manufacturer used for submittal.

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### SIGNAGE

- b. Prior to submittal, Contractor shall verify that all colors submitted as samples match accurately the samples or specifications provided by Architect.
  2. Character (Letter and Number) Style: Characters size as indicated on the Drawings or, if not indicated, comply with CBC 1117B5.5. Character style shall be Sans Serif uppercase letters, accompanied by California Contracted Grade 2 Braille. Lettering shall be raised minimum 1/32-inches above sign surface.
- F. Prototypes: Submit one complete prototype each for the following Sign Types (to follow). Do not submit prototypes prior to approval of shop drawings.
  - G. Mock-ups: (to follow if applicable).
  - H. Patterns: Submit one full size pattern each for Sign Types (to follow). All patterns shall be solid black vinyl graphics on a white background and shall include the complete perimeter of the sign panel.
  - I. Quality Control:
    1. Samples, mock-ups and prototypes shall not be permanently installed, but shall be retained by the Architect for record and quality control, unless otherwise noted by the Architect.
    2. If requested by Architect, submit manufacturer's installation instructions for each type of specialty sign. Include only pages that are pertinent, or manufacturer's standard drawings modified to delete non-applicable data.

## 1.6 QUALITY ASSURANCE

- A. Do not scale drawings for dimensions. Use only the written dimensions indicated on the Drawings, unless such are found in error. Contractor shall verify and be responsible for all dimensions and conditions shown by the Drawings, and shall visit the site to inspect and verify field conditions prior to fabrication and installation. The Architect shall be notified, in writing, of all discrepancies on Drawings, in field dimensions or conditions, and of changes required in construction details.
- B. Provide each type of sign as a complete unit produced by a single manufacturer, including all required mounting accessories, fittings and fastenings.
- C. All details shown in the Drawings shall be followed for exterior appearance. Minor changes in interior construction will be accepted in order to conform to Contractor's shop practices or engineering requirements when, in the Architect's sole judgment, such changes do not detract materially from design concept or intent. Contractor shall circle all such changes on the shop drawings.
- D. Completed work shall be structurally sound, and free from scratches, distortions, chips, breaks, blisters, holes, splits or other disfigurements considered as imperfections for the specific material.

## **PART 2 - PRODUCTS**

### **2.1 ACCEPTABLE SIGN FABRICATORS**

- A. Martinelli Environmental Graphics; San Francisco, CA (415) 621-1559. Attn: Jack Martinelli
- B. VKK Signmakers; Redwood City, CA (650) 368-3688. Attn: Dan Kitzmiller
- C. Weidner Architectural Signage; Sacramento, CA (916) 452-8000. Attn: Rick Weidner
- D. The proposed substitution of other sign fabricators for those listed above may be considered by the Architect if said sign fabricator(s):
  - 1. Demonstrates that his/her applicable product(s) are equal in salient characteristics such as construction, quality, durability, appearance and warranty to those of the acceptable sign fabricators listed.
  - 2. Demonstrates that the key personnel to be assigned to the project have a consistent history of thorough quality control, adherence to schedule and promptness of communication equal to those of the acceptable sign fabricators listed. Said key personnel shall include the project manager, the shop supervisor, the art department supervisor and the lead installer.
  - 3. Supplies three positive references from reputable environmental graphic design consultants for comparable work.

### **2.2 MATERIALS**

- A. Aluminum:
  - 1. Extruded Shapes: Provide alloy 6063; size as required, or as specified by Engineer.
  - 2. Flat Sheet: Provide alloy 3003; mill finish as specified, for all Work which will receive a painted finish.
- B. Cast Acrylic Sheet:
  - 1. Provide cast (not extruded or continuous cast) methyl plastic sheet, in sizes, thickness and finishes indicated, with a minimum flexural strength of 16,000 pounds per square inch when tested in accordance with ASTM D790, and a maximum allowable continuous service temperature of 176 degrees Fahrenheit.
  - 2. Cast acrylic sheet shall have a flame resistance such that application of a lighted match shall not produce melting, flashing, flaring or distortion. This material shall not ignite at a temperature less than 800 degrees Fahrenheit.
  - 3. Carefully follow manufacturer's recommended fabrication procedures regarding expansion/contraction, fastening and restraining of acrylic plastic.
- C. Tactile Signs (Interior Grade):
  - 1. Provide light sensitive photopolymer layer/polyester base, manufactured to produce a hardened, etched surface with 1/32" relief copy and/or Braille dots after exposure to ultraviolet light. Wash and post-wash exposed materials in accordance with manufacturer's instructions.
  - 2. Produce tactile signs with etched polymer type WFH 95 as manufactured by BASF, Pittman, or approved equal. Sign Face Finish: Provide acrylic lacquer, high volume spray applied.

## **SIGNAGE**

- 3. Text and/or Graphics Finish: Provide multiplastic or other paint silkscreened for high adhesion. Coating shear lines to precisely reflect letterforms and/or graphic outline contours.
- 4. Protective Sign Finish: Provide nonglare transparent acrylic lacquer glaze.
- 5. Laminated Photopolymer:
  - a. Sign Face: Provide photosensitive polyamide resin emulsion.
  - b. Sign Face Carrier: Provide .011 polyester film.
  - c. Laminating Material: Provide high bond, pressure sensitive, high viscosity adhesive.
    - 1) Pre-laminated Photopolymer: Provide .033" acrylic photopolymer bonded to .080 inch phenolic backing (overall thickness 1/8") as manufactured by below, or approved equal:

JET USA Corporation  
 1116 MacDade Blvd.  
 Collingdale, PA 19023  
 (800) 528-1153

D. Tactile Signs (Exterior Grade):

- 1. Provide exterior grade light-sensitive photopolymer layer of PVA/urethane base composition, manufactured to produce an etched surface with 1/32" relief copy and/or Braille dots after exposure to ultraviolet light, and with a minimum 95 Shore D durometer hardness rating. Photopolymer to be processed and baked to factory specifications only. Wash and post-wash exposed materials in accordance with manufacturer's instructions.
- 2. Sign Face Primer: Provide Matthews #74-777 Tie Bond.
- 3. Sign Face Topcoat: Provide Matthews Acrylic Polyurethane.
- 4. Text and/or Graphics Finish: Provide multiplastic or other paint silkscreened for high adhesion. Coating shear lines to precisely reflect letterforms and/or graphic outline contours.
- 5. Protective Sign Finish: Provide Matthews #SOA-4158 ADA clear, applied per manufacturer's instructions.
- 6. Pre-laminated Photopolymer: Provide photopolymer layer integral with 1/8" phenolic backing as manufactured by below, or approved equal:

JET USA Corporation  
 1116 MacDade Blvd.  
 Collingdale, PA 19023  
 (800) 528-1153

E. Braille: Contractor shall be responsible for the accurate translation of all 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 (2.54 mm) on centers in each cell with 2/10 inch (5.08 mm) space between cells. Dots shall be raised a minimum of 1/40 inch (0.635 mm) above the background.

F. Fasteners, Hardware and Devices: Stock proprietary fastening devices of approved standard manufacture such as cadmium plated screws, bolts and washers, and stainless steel hinges.

- 1. Conceal all fasteners except where noted or shown otherwise.
- 2. Finish on all exposed devices to match overall sign finish, unless otherwise noted.

3. Provide vandal-resistant fasteners at all exposed locations unless otherwise noted.
  4. Use fasteners fabricated from metals that are noncorrosive to either the sign material(s) or the mounting surface.
- G. Very High Bond Tape: Provide #4905/.020"/clear and/or #4950/.045"/white closed cell acrylic foam carrier with VHB adhesive, very high solvent resistance and very high shear and peel adhesion, as manufactured by 3M Scotch or approved equal.
- H. Acrylic Polyurethane Paint:
1. Provide acrylic polyurethane with ultraviolet inhibitors and lightfast, weather, abrasion and graffiti resistant additives as manufactured by Matthews Paint Company, (800) 323-6593. Prime and finish coats shall be mixed and applied in accordance with manufacturer's specifications. Paint finish shall be smooth, free of scratches, gouges, drops, bubbles, thickness variations, foreign matter or other imperfections.
    - a. Provide a CCR Title 24-compliant nonglare finish for all interior applications.
    - b. Provide a semigloss finish for all exterior applications.
      - 1) Colored Coatings for Cast Acrylic Sheet: Use paints for background color which are recommended by acrylic manufacturer for optimum adherence to acrylic surfaces and are non-fading for application intended.
      - 2) Contractor shall provide verification of paint manufacturer used for all paintwork.
- I. Screen Media:
1. Screened graphics shall be produced with screening ink or paint compatible with substrate, using mesh of 390 or finer to produce clean, sharp edges. Media are to be opaque, with full even coverage, and free from hickeys, dust, bubbles and/or other blemishes or foreign matter.
- J. Vinyl Film: Provide opaque reflective or non-reflective vinyl film as indicated, 0.0355" minimum thickness, with pressure sensitive permanent adhesive backing; 3M Scotchcal or approved equal. All colors shall be integral and not surface applied except where custom color(s) are specified in the Drawings. All custom colors shall be flood coated on white vinyl.
- K. Artwork for Evacuation Maps:
1. Owner shall provide approved digital artwork for one representative map as an Adobe Illustrator CS file for Macintosh. Contractor shall use this artwork as a template for all required maps.
  2. Generate all required artwork for all remaining maps, based on the graphic layout/colors approved by the San Mateo Fire Department (SMFD) map locations shown on the Sign Location Plans, and fire extinguisher cabinet and fire alarm pull box locations provided by Owner. Contractor shall then obtain written approval from the SMFD of all locations and primary and secondary exit routes shown on these maps.
  3. Submit full size color prints of all maps approved by the SMFD to Owner for final review of graphic layouts and obtain Owner's written approval of same prior to fabrication.
  4. Submit one full size color evacuation map to Owner for final approval of color. All subsequent color prints shall match this approved sample, which will be retained by Owner for quality control.

**2.3 FABRICATION**

- A. Intent of Specifications: All finished work shall be of the highest quality in order to pass eye-level examination and scrutiny by Architect.
1. All Work shall be free from burrs, dents, raw edges and sharp corners.
  2. Finish all welds on exposed surfaces as required so they are not visible in the finished Work.
  3. Finish all surfaces smooth unless otherwise indicated or specified.
  4. Surfaces which are intended to be flat shall be free from bulges, oilcanning, gaps or other physical deformities. Such surfaces shall be fabricated to remain flat under installed conditions.
  5. Surfaces which are intended to be curved shall be smoothly free-flowing to the required shape(s).
  6. Fabricate all cabinets, panels and components with smooth, mechanically finished edges. All edges shall be true, and all corners shall be square. Where edges are specified to be painted, fill and sand smooth as required prior to painting.
  7. Cut routed letterforms and/or graphics clean and true to match adjacent surface-applied letterforms and/or graphics.
  8. Fabricate all internally illuminated sign cabinets as required to provide a weathertight housing for all lighting and electrical components.
  9. Exercise care to protect all polished and/or plated surfaces so that they remain unblemished in the finished Work.
  10. Isolate dissimilar materials. Exercise particular care to isolate nonferrous metals from ferrous metals as required to prevent corrosion.
  11. All surfaces shall be flat to a tolerance of plus or minus 1/16' when measured at any point with a ten foot straight edge.
  12. All visible sign surfaces of the same type shall have the same finish. Color and/or finish shall be consistent across the entire surface of a sign.
  13. All reveals shall be of uniform width; all butt joints shall be tight and closed along the entire length; all access panels shall have a nominal, uniform gap all around.
  14. All expansion joints, when required, shall be positioned so as not to interfere with the look or finish of any sign message or the overall appearance of the sign face.
  15. All gaps between milled components, when assembled, shall not exceed a tolerance of .005".
- B. Provide colors and/or finish textures as specified or indicated in the Drawings or, where not specified or indicated, as selected by Architect.
1. Interior Colors/Finishes: Colors of sign graphics (text, arrows and/or symbols) shall contrast with sign background behind graphics. Finish shall be nonglare on all sign backgrounds behind graphics on identifications and directional signs.
- C. Graphics: All text, arrows and symbols shall be provided in the sizes, colors, typefaces and spacing specified in the Drawings. All text shall be a true, clean, digitally or photomechanically accurate reproduction of the typeface(s) specified, with letter spacing and directional arrows as shown in the Drawings.
1. Text: Use Adobe Type Library (typeface to follow). No substitutions.
  2. Arrows and Symbols: Use digital files provided by Architect in Adobe Illustrator for Macintosh.

- D. Sign Schedule: Copy shown in the Drawings is for layout purposes only; all final copy, quantities and references for all signs are shown in the Sign Schedule unless otherwise noted. The Contractor shall clarify any perceived irregularities in the Sign Schedule or between the sign schedule and the sign location plans with the Architect prior to fabrication.
- E. Digital Artwork: All digital artwork files prepared by the Architect for the Contractor's use shall be in a single layer. Any and all manipulations of the files required for subsequent use by the Contractor, such as spreads and traps for silkscreen negatives, or conversion to outline or EPS, shall be the responsibility of same unless explicitly agreed otherwise by the Architect.

## **PART 3 - EXECUTION**

### **3.1 INSPECTION**

- A. Architect reserves the right to inspect the Work in the Contractor's shop before it is shipped to the job site for installation.
- B. Contractor shall inspect all installation locations for conditions that will adversely affect the execution, permanence and/or quality of the Work, and notify Architect in writing of any and all unsatisfactory conditions. Contractor shall not proceed with installation until said unsatisfactory conditions have been corrected. Commencement of installation indicates acceptance of site conditions and guarantees delivery of an acceptable product.

### **3.2 SIGN LOCATIONS**

- A. All signs identifying permanent rooms and spaces shall be located in compliance with CBC 1117B.5.9: Center of sign to be 5'0" 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.
- B. Symbol signs on restroom doors shall be located in compliance with CBC 1115B.5: Center of sign to be 5'0" above finish floor. Sign to be centered left to right on door.
- C. Emergency Evacuation Map: Bottom of sign to be 4'0" above finish floor or as directed by Fire Department.

### **3.3 SITE CLEANUP**

- A. Final cleanup:
  - 1. Clean and/or repair all evidence of installation work or damage to site work or other adjacent surfaces prior to completion of work.
  - 2. Clean up work area after all installation has been completed. Restore all disturbed ground cover.
  - 3. Remove all protective materials and dispose of properly off site.

### **3.4 CLEANING AND PROTECTION**

- A. At completion of installation, clean all sign surfaces in accordance with manufacturer's instructions.

## **SIGNAGE**

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- B. Protect all signs from damage until acceptance by 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.

**3.5 CONTRACT CLOSE-OUT ITEMS**

- A. Provide Owner with one quart of paint for each paint color specified.
- B. Provide Owner with written instructions for proper cleaning of the signs. Note any solvents that are not to be used.

**- END OF SECTION -**





SAN MATEO COUNTY  
COMMUNITY COLLEGE DISTRICT  
SIGNAGE STANDARDS

COLLEGE OF SAN MATEO  
BUILDING 5N PROJECT

SAN MATEO COUNTY COMMUNITY COLLEGE DISTRICT  
SIGNAGE COLOR STANDARDS

BUILDING 5N PROJECT

BACKGROUND COLORS

SKYLINE BONE



COPY/PICTOGRAM COLORS

SKYLINE COLLEGE

3M SCOTCHCAL SERIES 220 PREMIUM FILM  
BLACK



## **INTERIOR SIGNAGE SPECIFICATIONS 3M3D Manufacturing**

### **Top Film - Empire Boltaron 2310**

Rigid, Clear, Embossed Poly Vinyl Chloride Calendered sheet, compounded with excellent balance or physical properties for use in membrane press process. Non-Glare, Matte Finish and embossed braille to meet ADA requirements.

### **Text Film -**

Determines Text/Copy/Pictogram Color  
3M Scotchcal Series 220 Premium Film

### **Profile Film -3M 1532**

Provides the raised Text/Copy/Pictogram 1/32" to meet ADA requirements/  
Embossed California Grade II braille  
Per UBC

### **Painted Background Color -**

Ellis Paints - Waterborne Acrylic Enamel

### **Laminating Adhesive -**

Sheet Adhesive

### **Substrate -**

Acrylic Backplate  
1/8" / 1/4" - Acrylite or equivalent

### **Mounting -**

3M VHB Foam Tape 1/32" thick

## **EXTERIOR SIGNAGE SPECIFICATIONS Drilled Braille**

### **Substrate - Exterior Grade**

Acrylic Faceplate  
Rohm & Haas Op3 Non Glare Acrylic  
1/8" or 1/4" Thick

### **Text -**

Rowmark ADA Alternative  
Applique 1/32"

### **Braille -**

1/16" Clear Glass Bead  
Raised 1/32" above substrate  
California Grade II Braille  
Per UBC

### **Painted Background Color -**

Ellis Paints - Waterborne Acrylic Enamel

### **Laminating Adhesive -**

Sheet Adhesive

### **Substrate -**

Acrylic Backplate  
1/8" / 1/4" - Acrylite or equivalent

### **Mounting -**

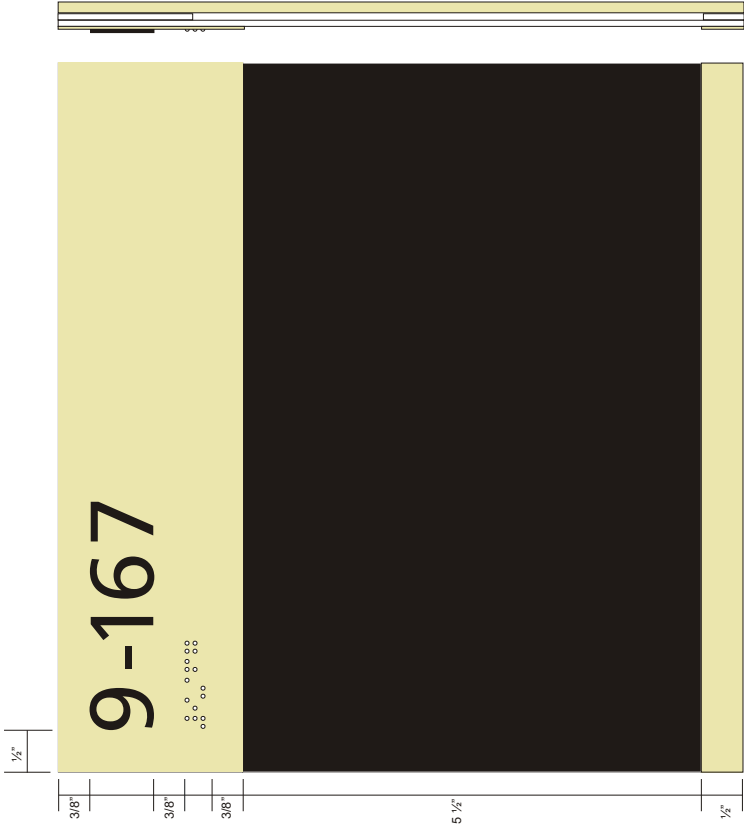
3M VHB Foam Tape 1/32" thick

Manufactured by:



1200 Industrial Road, Unit 14  
San Carlos, CA 94070  
650-593-8974-p 650-591-0319-f

SIGN TYPE SUBSTITUTED FOR 14/G8.03  
 SIGN TYPE ID.12  
 OFFICE IDENTIFICATION



Sign Type: 1 CLASS ROOM/OFFICE  
 Quantity: \_\_\_\_\_  
 Size: 8 1/4" X 8 1/2" X 1/4"

**BACKGROUND**  
 COLORS: SKYLINE BONE  
 SUB SURFACE GRAPHICS: 3M3D RAISED TEXT  
 BACKPLATE COLOR (S): PAINTED SKYLINE BONE  
 THICKNESS: 1/8"  
 MATERIAL: 3M3D OVERLAY OVER PLEXIGLASS

**TEXT**  
 LETTER STYLE (FONT): FRUTIGER BOOK  
 COLOR: BLACK  
 HEIGHT: 3/4"  
 POSITION/MARGIN/JUSTIFICATION: L.J.

**EDGES**  
 ROUTED:  X  BEVELED: \_\_\_\_\_ CUSTOM EDGE TREATMENT: \_\_\_\_\_ POLISHED: \_\_\_\_\_

**BRILLE**  
 NONE: \_\_\_\_\_ EMBOSSED:  X \_\_\_\_\_ RASTER/COLOR: \_\_\_\_\_

**CORNERS**  
 SQUARE:  X \_\_\_\_\_ RADIUS(SIZE): \_\_\_\_\_

**MOUNTING**  
 D/S TAPE:  X \_\_\_\_\_ VELCRO: \_\_\_\_\_ HOLES: \_\_\_\_\_ MAGNETIC: \_\_\_\_\_

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 WINDOW SIZE: 5 1/2" X 8 1/2" INSERT SIZE: 5 11/16" X 8 1/2"

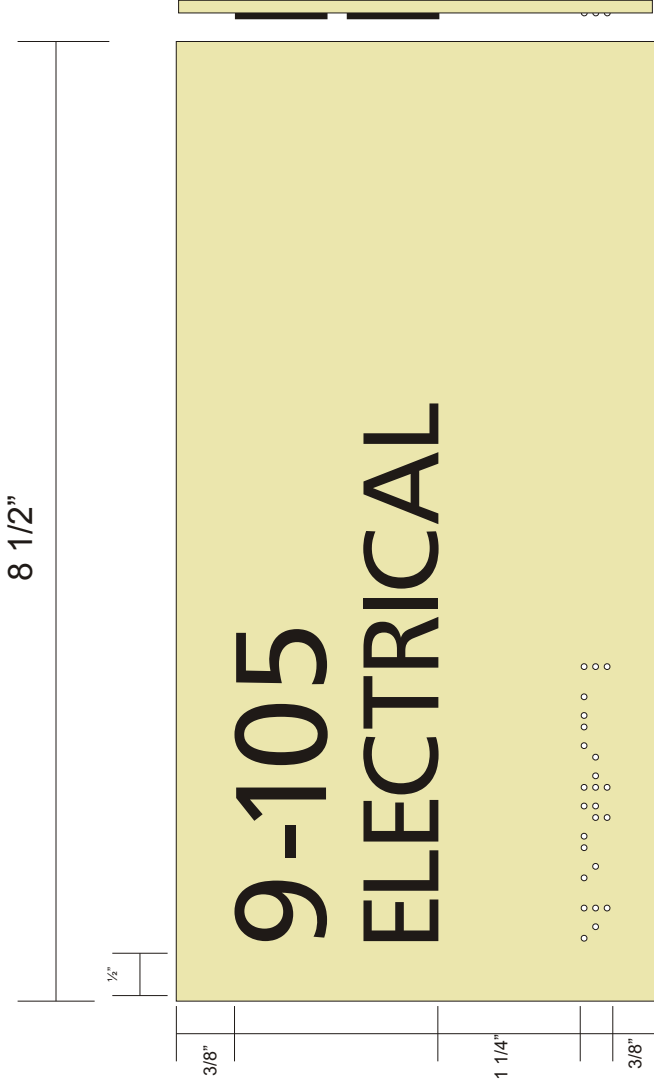
SCHOOL: CSM

PROJECT NAME: BLDG 5N

PROJECT NOTES:

SAN MATEO COUNTY  
 COMMUNITY COLLEGE DISTRICT  
 SIGN LAYOUT SHEET

SIGN TYPE SUBSTITUTED FOR 12/G8.03  
 SIGN TYPE ID.10  
 ROOM IDENTIFICATION



Sign Type: 4 INFRASTRUCTURE  
 Quantity: \_\_\_\_\_  
 Size: 4" X 8 1/2" X 1/8"

**BACKGROUND**  
 COLORS: SKYLINE BONE  
 SUB SURFACE GRAPHICS: 3M3D RAISED TEXT  
 BACKPLATE COLOR (S) PAINTED SKYLINE BONE  
 THICKNESS: 1/8"  
 MATERIAL: 3M3D OVERLAY OVER PLEXIGLASS

**TEXT**  
 LETTER STYLE (FONT): FRUTIGER BOOK  
 COLOR: BLACK  
 HEIGHT: 3/4"  
 POSITION/MARGIN/JUSTIFICATION: L.J.

**EDGES**  
 ROUTED: X BEVELED: \_\_\_\_\_ CUSTOM EDGE TREATMENT: \_\_\_\_\_ POLISHED: \_\_\_\_\_

**BRAILLE**  
 NONE: X EMBOSSED: \_\_\_\_\_ RASTER/COLOR: \_\_\_\_\_

**CORNERS**  
 SQUARE: X RADIUS(SIZE): \_\_\_\_\_

**MOUNTING**  
 D/S TAPE: X VELCRO: \_\_\_\_\_ HOLES: \_\_\_\_\_ MAGNETIC: \_\_\_\_\_

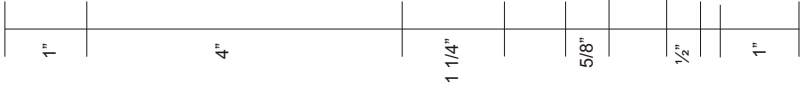
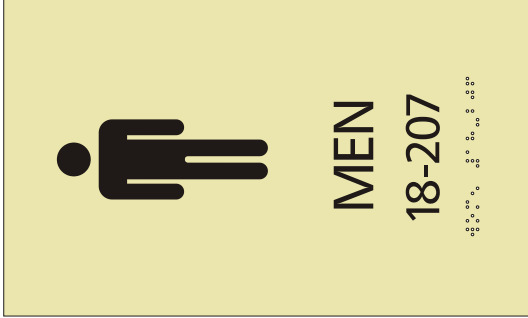
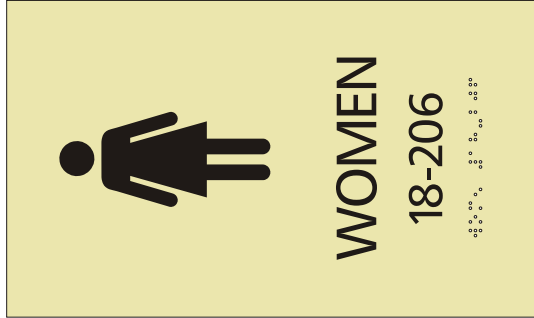
INSERT WINDOW  
 WINDOW SIZE: \_\_\_\_\_ INSERT SIZE: \_\_\_\_\_

SCHOOL: CSM

PROJECT NAME: BLDG 5N

PROJECT NOTES:

SAN MATEO COUNTY  
 COMMUNITY COLLEGE DISTRICT  
 SIGN LAYOUT SHEET



Sign Type: 5 ADA RESTROOM WALL WITH ROOM NUMBER

Quantity: \_\_\_\_\_

Size: 10" X 6" X 1/8"

**BACKGROUND**

COLORS: SKYLINE BONE  
 SUB SURFACE GRAPHICS:  3M3D RAISED TEXT  
 BACKPLATE COLOR (S): PAINTED SKYLINE BONE  
 THICKNESS: 1/8"  
 MATERIAL: 3M3D OVERLAY OVER PLEXIGLASS

**TEXT**

LETTER STYLE (FONT): FRUTIGER BOOK  
 COLOR: BLACK  
 HEIGHT: 3/4"  
 POSITION/MARGIN/JUSTIFICATION: L.J.

**EDGES**

ROUTED:  X  BEVELED: \_\_\_\_\_ CUSTOM EDGE TREATMENT: \_\_\_\_\_ POLISHED: \_\_\_\_\_

**BRAILLE**

NONE: \_\_\_\_\_ EMBOSSED:  X \_\_\_\_\_ RASTER/COLOR: \_\_\_\_\_

**CORNERS**

SQUARE:  X \_\_\_\_\_ RADIUS(SIZE): \_\_\_\_\_

**MOUNTING**

D/S TAPE:  X \_\_\_\_\_ VELCRO: \_\_\_\_\_ HOLES: \_\_\_\_\_ MAGNETIC: \_\_\_\_\_

**INSERT WINDOW**

WINDOW SIZE: \_\_\_\_\_ INSERT SIZE: \_\_\_\_\_

SAN MATEO COUNTY  
 COMMUNITY COLLEGE DISTRICT  
 SIGN LAYOUT SHEET

SCHOOL: CSM

PROJECT NAME: BLDG 5N

PROJECT NOTES:

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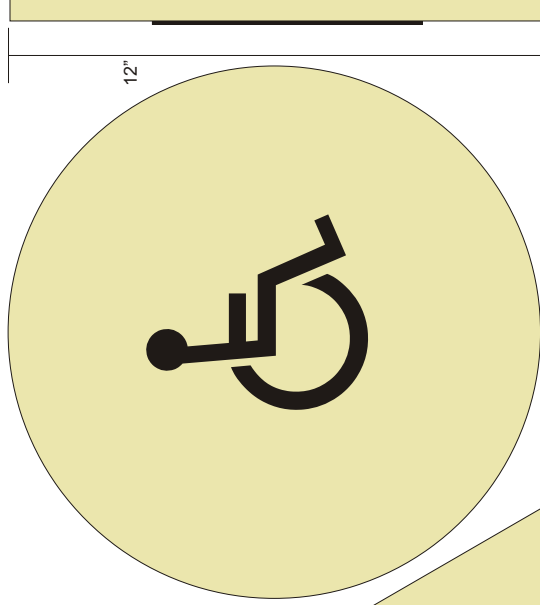
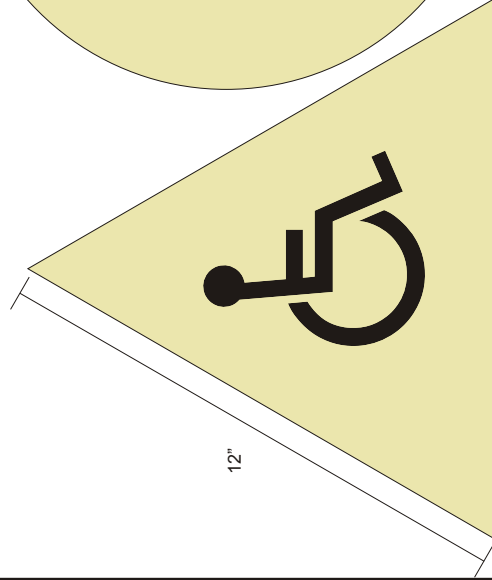


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**SIGN TYPE SUBSTITUTED FOR 6/G8.03  
SIGN TYPE CD.6  
MEN'S RESTROOM DOOR**



**SIGN TYPE SUBSTITUTED FOR 5/G8.03  
SIGN TYPE CD.5  
WOMEN'S RESTROOM DOOR**

Sign Type: 6 T24 RESTROOM DOOR  
Quantity: \_\_\_\_\_  
Size: 12" X 1/4"

BACKGROUND  
COLORS: SKYLINE BONE  
SUB SURFACE GRAPHICS:  3M3D RAISED TEXT  
BACKPLATE COLOR (S): PAINTED SKYLINE BONE  
THICKNESS: 1/4"  
MATERIAL: PLEXIGLASS

TEXT  
LETTER STYLE (FONT): PICTOGRAM  
COLOR: BLACK  
HEIGHT: 6"  
POSITION/MARGIN/JUSTIFICATION: CENTER/CENTER

EDGES  
ROUTED:  X BEVELED: \_\_\_\_\_ CUSTOM EDGE TREATMENT: \_\_\_\_\_ POLISHED: \_\_\_\_\_

BRAILLE  
NONE:  X EMBOSSED: \_\_\_\_\_ RASTER/COLOR: \_\_\_\_\_

CORNERS  
SQUARE:  X RADIUS(SIZE): \_\_\_\_\_

MOUNTING  
D/S TAPE:  X VELCRO: \_\_\_\_\_ HOLES: \_\_\_\_\_ MAGNETIC: \_\_\_\_\_

INSERT WINDOW  
WINDOW SIZE: \_\_\_\_\_ INSERT SIZE: \_\_\_\_\_

**SAN MATEO COUNTY  
COMMUNITY COLLEGE DISTRICT  
SIGN LAYOUT SHEET**

SCHOOL: CSM

PROJECT NAME: BLDG 5N

PROJECT NOTES:

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SIGN TYPE SUBSTITUTED FOR 7/G8.03  
 SIGN TYPE CD.7  
 UNISEX RESTROOM DOOR



Sign Type: 6 T24 RESTROOM DOOR  
 Quantity: \_\_\_\_\_  
 Size: 12" X 1/2"

**BACKGROUND**  
 COLORS: SKYLINE BONE  
 SUB SURFACE GRAPHICS:  3M3D RAISED TEXT  
 BACKPLATE COLOR (S): PAINTED SKYLINE BONE  
 THICKNESS: 1/4" + 1/4"  
 MATERIAL: PLEXIGLASS

**TEXT**  
 LETTER STYLE (FONT): PICTOGRAM  
 COLOR: BLACK  
 HEIGHT: 6"  
 POSITION/MARGIN/JUSTIFICATION: CENTER/CENTER

**EDGES**  
 ROUTED:  X BEVELED: \_\_\_\_\_ CUSTOM EDGE TREATMENT: \_\_\_\_\_ POLISHED: \_\_\_\_\_

**BRAILLE**  
 NONE:  X EMBOSSED: \_\_\_\_\_ RASTER/COLOR: \_\_\_\_\_

**CORNERS**  
 SQUARE:  X RADIUS(SIZE): \_\_\_\_\_

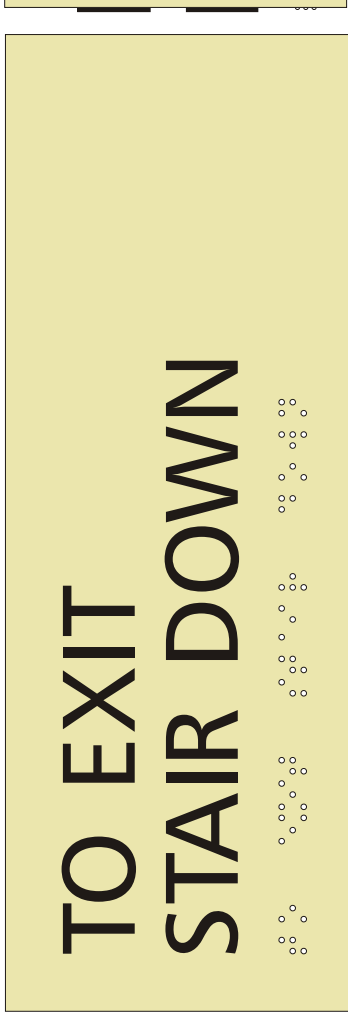
**MOUNTING**  
 D/S TAPE:  X VELCRO: \_\_\_\_\_ HOLES: \_\_\_\_\_ MAGNETIC: \_\_\_\_\_

INSERT WINDOW  
 WINDOW SIZE: \_\_\_\_\_ INSERT SIZE: \_\_\_\_\_

SAN MATEO COUNTY  
 COMMUNITY COLLEGE DISTRICT  
 SIGN LAYOUT SHEET

SCHOOL: CSM  
 PROJECT NAME: BLDG 5N  
 PROJECT NOTES:  
 \_\_\_\_\_  
 \_\_\_\_\_

SIGN TYPE SUBSTITUTED FOR 4/G8.03  
SIGN TYPE CD.4  
TACTILE EXIT SIGN



1/2"

3/8"

3/8"

Sign Type: 9 EXIT  
Quantity: \_\_\_\_\_  
Size: 3' X 8 1/2" X 1/8"

BACKGROUND  
COLORS: SKYLINE BONE  
SUB SURFACE GRAPHICS:  3M3D RAISED TEXT  
BACKPLATE COLOR (S): PAINTED SKYLINE BONE  
THICKNESS: 1/8"  
MATERIAL: 3M3D OVERLAY OVER PLEXIGLASS

TEXT  
LETTER STYLE (FONT): FRUTIGER BOOK  
COLOR: BLACK  
HEIGHT: .5/8"  
POSITION/MARGIN/JUSTIFICATION: L.J.

EDGES  
ROUTED:  X BEVELED: \_\_\_\_\_ CUSTOM EDGE TREATMENT: \_\_\_\_\_ POLISHED: \_\_\_\_\_

BRILLE  
NONE: \_\_\_\_\_ EMBOSSED:  X RASTER/COLOR: \_\_\_\_\_

CORNERS  
SQUARE:  X RADIUS(SIZE): \_\_\_\_\_

MOUNTING  
D/S TAPE:  X VELCRO: \_\_\_\_\_ HOLES: \_\_\_\_\_ MAGNETIC: \_\_\_\_\_

INSERT WINDOW  
WINDOW SIZE: \_\_\_\_\_ INSERT SIZE: \_\_\_\_\_

SCHOOL: CSM

PROJECT NAME: BLDG 5N

PROJECT NOTES:

SAN MATEO COUNTY  
COMMUNITY COLLEGE DISTRICT  
SIGN LAYOUT SHEET

SIGN TYPE SUBSTITUTED FOR 1/G8.03  
SIGN TYPE CD.1  
EMERGENCY EVACUATION MAP

# EMERGENCY EVACUATION PLAN



3/4"

5/8"

9/16"

3/4"

Sign Type: 10 EVACUATION MAP HOLDER

Quantity: \_\_\_\_\_

Size: 11" W X 12" H X 1/4"

**BACKGROUND**

COLORS: SKYLINE BONE

SUB SURFACE GRAPHICS:  3M3D SECOND SURFACE NON RAISED TEXT

BACKPLATE COLOR (S): PAINTED SKYLINE BONE

THICKNESS: 1/8"

MATERIAL: PLEXIGLASS

**TEXT**

LETTER STYLE (FONT): FRUTIGER BOOK

COLOR: BLACK

HEIGHT: 3/4"

POSITION/MARGIN/JUSTIFICATION: L.J.

**EDGES**

ROUTED:  X  BEVELED: \_\_\_\_\_ CUSTOM EDGE TREATMENT: \_\_\_\_\_ POLISHED: \_\_\_\_\_

**BRAILLE**

NONE:  X  EMBOSSED: \_\_\_\_\_ RASTER/COLOR: \_\_\_\_\_

**CORNERS**

SQUARE:  X  RADIUS(SIZE): \_\_\_\_\_

**MOUNTING**

D/S TAPE:  X  VELCRO: \_\_\_\_\_ HOLES: \_\_\_\_\_ MAGNETIC: \_\_\_\_\_

**INSERT WINDOW**

WINDOW SIZE: 8 1/4" X 11" INSERT SIZE: 8 1/2" X 11"

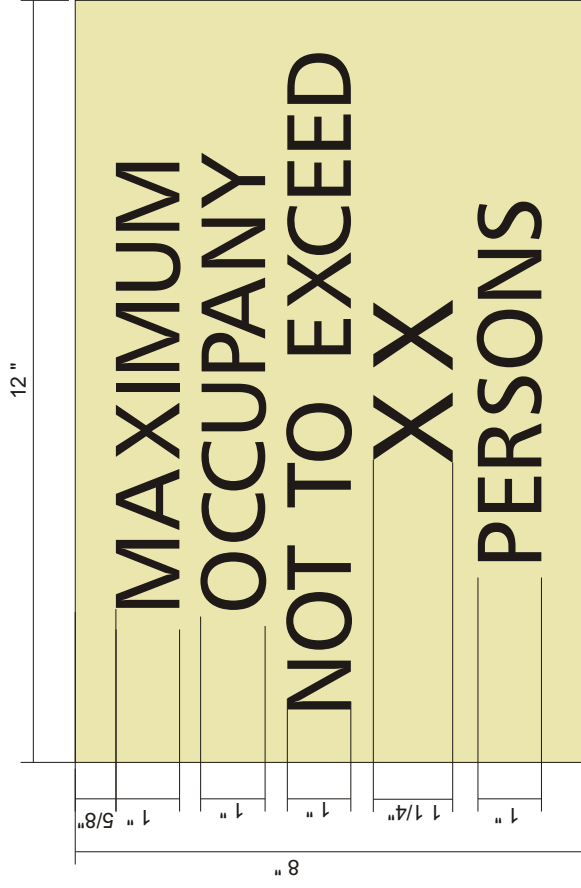
SAN MATEO COUNTY  
COMMUNITY COLLEGE DISTRICT  
SIGN LAYOUT SHEET

SCHOOL: CSM

PROJECT NAME: BLDG 5N

PROJECT NOTES:

SIGN TYPE SUBSTITUTED FOR 2/G8.03  
SIGN TYPE CD.2  
MAXIMUM OCCUPANCY



Sign Type: 11 MAXIMUM OCCUPANCY  
Quantity: \_\_\_\_\_  
Size: 8" X 12" X 1/8"

**BACKGROUND**

COLORS: SKYLINE BONE  
SUB SURFACE GRAPHICS: 3M3D RAISED TEXT  
BACKPLATE COLOR (S) PAINTED SKYLINE BONE  
THICKNESS: 1/8"  
MATERIAL: 3M3D OVERLAY OVER PLEXGLASS

**TEXT**

LETTER STYLE (FONT): FRUTIGER BOOK  
COLOR: BLACK  
HEIGHT: 1" & 1 1/4"  
POSITION/MARGIN/JUSTIFICATION: STACK AND CENTER

**EDGES**

ROUTED:  BEVELED:  CUSTOM EDGE TREATMENT:  POLISHED:

**BRILLE**

NONE:  EMBOSSED:  RASTER/COLOR: \_\_\_\_\_

**CORNERS**

SQUARE:  RADIUS (SIZE): \_\_\_\_\_

**MOUNTING**

D/S TAPE:  VELCRO:  HOLES:  MAGNETIC:

**INSERT WINDOW**

WINDOW SIZE: \_\_\_\_\_ INSERT SIZE: \_\_\_\_\_

SAN MATEO COUNTY  
COMMUNITY COLLEGE DISTRICT  
SIGN LAYOUT SHEET

SCHOOL: CSM

PROJECT NAME: BLDG 5N

PROJECT NOTES:

**SIGN TYPE SUBSTITUTED FOR 3/G8.03  
SIGN TYPE CD.3  
ASSISTIVE LISTENING SIGN**



Sign Type: 12 ASSISTIVE LISTENING  
Quantity: \_\_\_\_\_  
Size: 7" X 12" X 1/8"

**BACKGROUND**  
COLORS: SKYLINE BONE  
SUB SURFACE GRAPHICS:  3M3D RAISED TEXT  
BACKPLATE COLOR (S): PAINTED SKYLINE BONE  
THICKNESS: 1/8"  
MATERIAL: 3M3D OVERLAY OVER PLEXIGLASS

**TEXT**  
LETTER STYLE (FONT): FRUTIGER BOOK  
COLOR: BLACK  
HEIGHT: 5/8" / 3"H X 2.3/4" PICTOGRAM  
POSITION/MARGIN/JUSTIFICATION: STACK AND CENTER

**EDGES**  
ROUTED:  X  BEVELED: \_\_\_\_\_ CUSTOM EDGE TREATMENT: \_\_\_\_\_ POLISHED: \_\_\_\_\_

**BRAILLE**  
NONE: \_\_\_\_\_ EMBOSSED:  X \_\_\_\_\_ RASTER/COLOR: \_\_\_\_\_

**CORNERS**  
SQUARE:  X \_\_\_\_\_ RADIUS (SIZE): \_\_\_\_\_

**MOUNTING**  
D/S TAPE:  X \_\_\_\_\_ VELCRO: \_\_\_\_\_ HOLES: \_\_\_\_\_ MAGNETIC: \_\_\_\_\_

INSERT WINDOW  
WINDOW SIZE: \_\_\_\_\_ INSERT SIZE: \_\_\_\_\_

**SAN MATEO COUNTY  
COMMUNITY COLLEGE DISTRICT  
SIGN LAYOUT SHEET**

SCHOOL: CSM

PROJECT NAME: BLDG 5N

PROJECT NOTES:

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SIGN TYPE SUBSTITUTED FOR 9/G8.03  
SIGN TYPE CD.9  
ISA BUILDING ENTRANCE



Sign Type: 20 ISA PLACARD  
Quantity: \_\_\_\_\_  
Size: 6" X 6"

BACKGROUND  
COLORS: FEDERAL BLUE  
SUB SURFACE GRAPHICS: NO VINYL COPY APPLIED TO GLASS  
BACKPLATE COLOR (S): \_\_\_\_\_  
THICKNESS: \_\_\_\_\_  
MATERIAL: \_\_\_\_\_

TEXT  
LETTER STYLE (FONT): N/A  
COLOR: WHITE  
HEIGHT: 4" ISA PICTOGRAM  
POSITION/MARGIN/JUSTIFICATION: CENTER

EDGES  
ROUTED: \_\_\_\_\_ BEVELED: \_\_\_\_\_ CUSTOM EDGE TREATMENT: \_\_\_\_\_ POLISHED: \_\_\_\_\_

BRILLE  
NONE: \_\_\_\_\_ EMBOSSED: \_\_\_\_\_ RASTER/COLOR: \_\_\_\_\_

CORNERS  
SQUARE: \_\_\_\_\_ X \_\_\_\_\_ RADIUS(SIZE): \_\_\_\_\_

MOUNTING  
D/S TAPE: \_\_\_\_\_ VELCRO: \_\_\_\_\_ HOLES: \_\_\_\_\_ MAGNETIC: \_\_\_\_\_

INSERT WINDOW  
WINDOW SIZE: \_\_\_\_\_ INSERT SIZE: \_\_\_\_\_

SAN MATEO COUNTY  
COMMUNITY COLLEGE DISTRICT  
SIGN LAYOUT SHEET

SCHOOL: CSM

PROJECT NAME: BLDG 5N

PROJECT NOTES:

Sign Type: CD.8 NOTICE ABOVE DOOR 8/G8.03  
Quantity: \_\_\_\_\_  
Size: 1" X 42 7/8"

BACKGROUND  
COLORS: BLACK  
SUB SURFACE GRAPHICS: Y/N  
BACKPLATE COLOR (S):  
THICKNESS:  
MATERIAL: 3M HIGH PERFORMANCE BLACK VINYL

TEXT  
LETTER STYLE (FONT): FRUTIGER BOOK  
COLOR: BLACK  
HEIGHT: 1"  
POSITION/MARGIN/JUSTIFICATION: CENTER

EDGES  
ROUTED: \_\_\_\_\_ BEVELED: \_\_\_\_\_ CUSTOM EDGE TREATMENT: \_\_\_\_\_ POLISHED: \_\_\_\_\_

BRILLE  
NONE: \_\_\_\_\_ EMBOSSED: \_\_\_\_\_ RASTER/COLOR: \_\_\_\_\_

CORNERS  
SQUARE: \_\_\_\_\_ RADIUS(SIZE): \_\_\_\_\_

MOUNTING  
D/S TAPE: \_\_\_\_\_ VELCRO: \_\_\_\_\_ HOLES: \_\_\_\_\_ MAGNETIC: \_\_\_\_\_

INSERT WINDOW  
WINDOW SIZE: \_\_\_\_\_ INSERT SIZE: \_\_\_\_\_

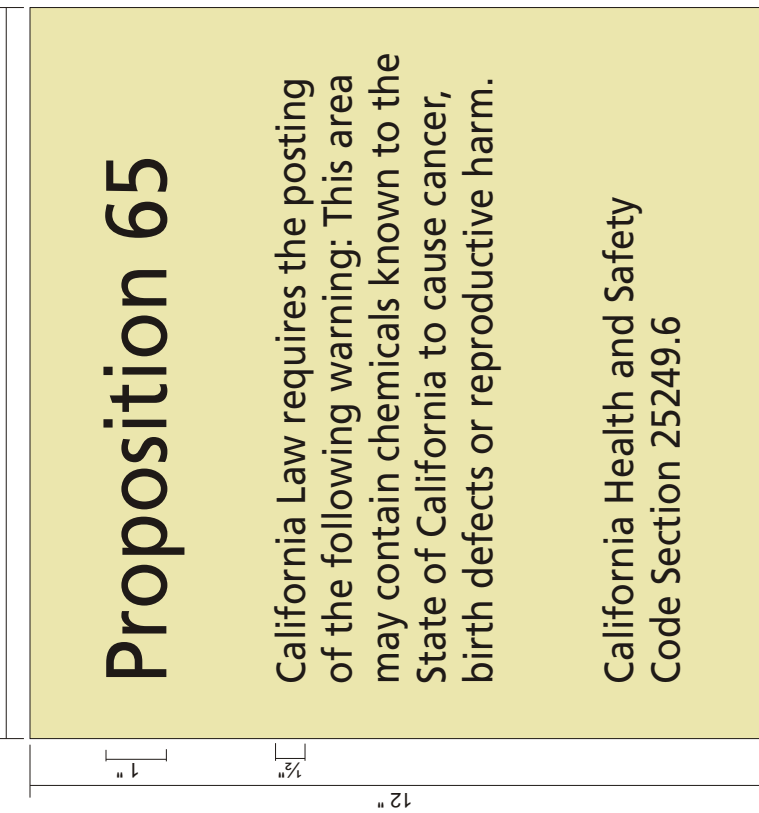
42 7/8"

THIS DOOR TO REMAIN UNLOCKED WHEN BUILDING IS OCCUPIED.

SCHOOL: CSM
PROJECT NAME: BLDG 5N
PROJECT NOTES:

# SAN MATEO COUNTY COMMUNITY COLLEGE DISTRICT SIGN LAYOUT SHEET

Sign Type: CD.10 PROP 65 10/G&O3  
 Quantity: \_\_\_\_\_  
 Size: 12" X 12"



**BACKGROUND**  
 COLORS: SKYLINE BONE  
 SUB SURFACE GRAPHICS: V/N  
 BACKPLATE COLOR (S): PAINTED SKYLING BONE  
 THICKNESS: 1/8"  
 MATERIAL: ACRYLIC

**TEXT**  
 LETTER STYLE (FONT): FRUTIGER BOOK  
 COLOR: WHITE  
 HEIGHT: 1" & 1/2"  
 POSITION/MARGIN/JUSTIFICATION: LEFT JUSTIFIED @ 1"

**EDGES**  
 ROUTED: X BEVELED: \_\_\_\_\_ CUSTOM EDGE TREATMENT: \_\_\_\_\_ POLISHED: \_\_\_\_\_

**BRILLE**  
 NONE: X EMBOSSED: \_\_\_\_\_ RASTER/COLOR: \_\_\_\_\_

**CORNERS**  
 SQUARE: X RADIUS(SIZE): \_\_\_\_\_

**MOUNTING**  
 D/S TAPE: X VELCRO: \_\_\_\_\_ HOLES: \_\_\_\_\_ MAGNETIC: \_\_\_\_\_

INSERT WINDOW  
 WINDOW SIZE: \_\_\_\_\_ INSERT SIZE: \_\_\_\_\_

SCHOOL: CSM  
 PROJECT NAME: BLDG 5N  
 PROJECT NOTES:

SAN MATEO COUNTY  
 COMMUNITY COLLEGE DISTRICT  
 SIGN LAYOUT SHEET



12"



12"

Sign Type: CD.11.RADIATION NOTICE 11/G8.03

Quantity: \_\_\_\_\_

Size: 12" X 12"

**BACKGROUND**

COLORS: YELLOW

SUB SURFACE GRAPHICS: V/N

BACKPLATE COLOR (S): CLEAR

THICKNESS: 1/8"

MATERIAL: ACRYLIC

**TEXT**

LETTER STYLE (FONT): FRUTIGER BOOK

COLOR: PURPLE

HEIGHT: 1" COPY & 5-1/2" PICTO

POSITION/MARGIN/JUSTIFICATION: CENTERED

**EDGES**

ROUTED:  BEVELED: \_\_\_\_\_ CUSTOM EDGE TREATMENT: \_\_\_\_\_ POLISHED: \_\_\_\_\_

**BRILLE**

NONE:  EMBOSSED: \_\_\_\_\_ RASTER/COLOR: \_\_\_\_\_

**CORNERS**

SQUARE:  RADIUS(SIZE): \_\_\_\_\_

**MOUNTING**

D/S TAPE:  VELCRO: \_\_\_\_\_ HOLES: \_\_\_\_\_ MAGNETIC: \_\_\_\_\_

**INSERT WINDOW**

WINDOW SIZE: \_\_\_\_\_ INSERT SIZE: \_\_\_\_\_

SCHOOL: CSM

PROJECT NAME: BLDG 5N

PROJECT NOTES:

**SAN MATEO COUNTY  
 COMMUNITY COLLEGE DISTRICT  
 SIGN LAYOUT SHEET**

**- SECTION 10 2113 -****TOILET COMPARTMENTS**

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**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. This Section includes the following:
  - 1. Compartment Style: Floor mounted, overhead braced Solid Color Reinforced Composite (SCRC) toilet compartments, urinal screens, shower dividers and dressing compartments.
    - a. Hardware and accessories.

**1.3 RELATED SECTIONS**

- A. Section 01 74 19 "Materials Recycling & Waste Management".
- B. Section 01 81 13 "LEED Certification Requirements".
- C. Section 05 5000 "Metal Fabrications" to provide misc blocking / backing for walls.
- D. Section 10 2800 "Toilet & Bath Accessories" for toilet compartment accessories and coordination of attachment.

**1.4 SUBMITTALS**

- A. Product Data: Submit manufacturer's product data, parts list, and catalog cut sheets.
  - 1. Furnish documentation on hardware, headrail, and continuous wall bracket to meet specification as outlined.
- B. LEED Submittals:
  - 1. Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
    - a. Include certificate indicating costs for each product having recycled content.
  - 2. Product Data for Credit EQ 4.4: For particleboard, documentation indicating that product contains no urea formaldehyde.

3. Product Data for Credit MR 5.1 and MR 5.2: Regional Materials: Materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site.
- C. Shop Drawings: Indicate layouts, swing of doors, elevations, anchorage and mounting details, components, hardware, finishes, and relevant dimensions.
  1. Furnish template drawings for anchorage locations in supporting members for attachment of compartments.
  2. Provide drawings showing locations for adequate steel reinforcements of wood blocking in walls to be provided by others for proper securing the finished work.
- D. Samples: Submit full range of color samples of finish on metal substrate for Architect's selections; color photo representations are not acceptable. Submit minimum 6-inch-square sample of specified color and finish on same substrate to be used in work, for Architect's color verification.
- E. Manufacturer's Instructions: Submit manufacturer's printed installation instructions.

## 1.5 QUALITY ASSURANCE

- A. Regulatory Requirements: Conform to ANSI A117.1 and International Building Code, Chapters 10 and 11B for provisions for the physically handicapped or local building Code if more stringent requirement is applicable.
- B. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible, to ensure proper fitting of work. However, allow for adjustments where taking of field measurements before fabrication might delay work.

## 1.6 SEQUENCING AND SCHEDULING

- A. Coordinate Work with placement of anchorage devices. Supply rough-in data in sufficient time to provide concealed preparatory work.
- B. Furnish inserts and anchorage, which must be built into other work for installation of toilet compartments and related items. Coordinate delivery with other work to avoid delay.

# PART 2 - GENERAL

## 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements provide Sierra Series 1090, Solid Color Reinforced Composite (SCRC) Toilet Partitions, from Bobrick Washroom Equipment, Inc. North Hollywood, CA. tel: (818) 503-1630, web site: [www.bobrick.com](http://www.bobrick.com). District Standard, No Substitutions allowed.

## 2.2 COMPONENTS/MATERIALS

- A. Stiles, Panels, Doors, and Screens:

### TOILET COMPARTMENTS

---

1. Stiles, Panels, Doors, and Screens shall be all be manufactured from Solid Color Reinforced Composite material.
- B. Toilet Partition Material:
1. Toilet partitions shall be constructed of Solid Color Reinforced Composite material, which is composed of dyes, organic fibrous material, and polycarbonate/phenolic resins. Material shall have a non-ghosting, graffiti resistant surface integrally bonded to core through a series of manufacturing steps requiring thermal and mechanical pressure. Edges of material shall be the same color as the surface. Color: SC04 – Forest Green.
  2. Toilet partitions constructed of High Density Polyethylene (HDPE) or High Density Polypropylene will not be acceptable.
- C. Finish Thickness:
1. Stiles and doors shall be 3/4 inch (19mm).
  2. Panels and benches shall be 1/2 inch (13mm).
- D. Hardware:
1. All hardware to be 18-8, type-304 stainless steel with satin finish.
  2. Hardware of chrome-plated “Zamak”, aluminum, or extruded plastic is unacceptable.
- E. Latch:
1. Sliding door latch shall be 14-gauge (2mm) and shall slide on nylon track.
  2. Sliding door latch shall require less than 5-lb force to operate. Twisting latch operation will not be acceptable.
  3. Latch track shall be attached to door by machine screws into factory-installed threaded brass inserts.
  4. Threaded brass inserts shall be factory installed for door hinge and latch connections and shall withstand a direct pull exceeding 1,500 lbs. per insert.
  5. Through-bolted, stainless steel, pin-in-head Torx sex bolt fasteners shall be used at latch keeper-to-stile connections and shall withstand direct pull force exceeding 1,500 lbs. per fastener.
- F. Hinges:
1. Hinge shall be 16-gauge (1.6mm) continuous piano-hinge.
  2. All doors shall be equipped with self-closing hinge.
  3. Continuous piano-hinge shall be attached to door and stile by theft-resistant, pin-in-head Torx stainless steel machine screws into factory installed, threaded brass inserts
  4. Fasteners secured directly into the core are not acceptable.
  5. Door shall be furnished with two 11-gauge (3mm) stainless steel door stop plates with attached rubber bumpers to resist door from being kicked in/out beyond stile.
  6. Door stops and hinges shall be secured with stainless steel, pin-in-head Torx machine screws into threaded brass inserts.
  7. Threaded brass inserts shall withstand a direct pull force exceeding 1,500 lbs per insert.
- G. Mounting Brackets
1. Mounting brackets shall be 18-gauge (1.2mm) stainless steel and extend full height of panel.
  2. U-channels shall be furnished to secure panels to stiles.

3. Angle brackets shall be furnished to secure stiles-to-walls and panels-to-walls.
  4. Fasteners at locations connecting panels-to-stiles shall utilize through-bolted, stainless steel, pin-in-head Torx sex bolt fasteners. Through-bolted fasteners shall withstand direct pull force exceeding 1,500 lbs. per fastener.
  5. Wall mounted urinal screen brackets shall be 11 gauge (3 mm) double thickness.
- H. Leveling Device shall be 7-gauge, 3/16 inch (5mm) hot rolled steel bar; chromate-treated and zinc-plated; through-bolted to base of solid color reinforced composite stile.
- I. Stile Shoe shall be one-piece, 4 inches (102mm) high, type-304, 22-gauge (0.8mm) stainless steel with satin-finish. Top shall have 90° return to stile. Shoe will be composed of one-piece of stainless steel and capable of being fastened (by clip) to stiles starting at wall line.
- J. Headrail (Overhead-Braced) shall be satin-finish, extruded anodized aluminum (.125"/ 3-mm thick) with antigrip profile.
- K. Compartment Hooks: In each toilet compartment, furnish and install a Bobrick B212 Clothes Hook and Bumper at 38 to 40 inches AFF for a barrier-free installation. Utilize through-bolted, stainless steel, pin-in-head Torx sec bolt fasteners.

## 2.3 FABRICATION

- A. Toilet Compartments: Floor supported-overhead braced design.
- B. Urinal Screens: Floor supported, wall hung-bracket supported design.
- C. General Requirements: Take field measurements to ensure proper fitting of Work. Shop assemble to greatest extent possible.
1. Provide standard doors, panels, screens, and pilasters fabricated for compartment system.
  2. Provide aluminum heat-sink strips at exposed bottom edges of HDPE units to prevent burning.
  3. Provide units with cutouts and drilled holes to receive compartment-mounted hardware, accessories, and grab bars, as indicated
- D. Compartment Pilasters: Widths required by compartment sizes and spacing.
1. Pilasters shall be 82 inches high, mounted with a one piece, stainless steel shoe, 3 inch height minimum, satin with star-head security pins.
  2. Equip with leveling devices, anchor studs, and locking nuts.
- E. Dividing panels shall be 55 inches high and mounted at 14 inches above finished floor.
- F. Compartment Doors: 55 inch height and mounted at 14 inches above finished floor, 36 inch minimum width at handicap compartments, and manufacturer's standard width at other compartments.
- G. Urinal Screens: Panel of 24 inch width, 42 inch height, unless indicated otherwise on Drawings. Same basic construction as components for toilet compartments.
- H. Pilasters shall be 82 inches high, mounted with a one piece plastic shoe with star-head security pin, stainless steel barrel bolts.

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## TOILET COMPARTMENTS

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine conditions prior to proceeding with Work.
  - 1. Check areas scheduled to receive compartments for correct dimensions, plumbness of walls, soundness of wall surfaces, location of built-in anchorage/supporting devices, and other conditions that would affect proper installation of holding brackets and anchorage or suspension devices.
  - 2. Verify spacing of plumbing fixtures to ensure compatibility with compartment installation.

### **3.2 INSTALLATION**

- A. General: Install in accordance with approved shop drawings.
  - 1. Install compartments and urinal screens rigid, straight, plumb, and level in accordance with manufacturer's printed instructions.
  - 2. Anchorage: Rigidly attach compartments to supporting construction. Do not use wood, plastic or fiber plugs.
  - 3. Ceramic Tile/Gypsum Board: Provide metal blocking between studs and screw attach to blocking.
  - 4. Maintain 1/2 inch maximum clearances between pilasters and panels.
  - 5. Maintain 1 inch maximum clearances between panels and walls.
  - 6. Secure panels to walls with not less than two stirrup brackets attached near top and bottom of panel.
  - 7. Secure screens with continuous bracket.
  - 8. Attach wall brackets with fastener holes located in tile joints.
  - 9. Conceal evidence of drilling, cutting, and fitting of room finishes.
- B. Floor Supported Overhead Braced Compartments: Secure pilasters to floor with pilaster supports anchored with 2 inch minimum penetration into floor system.
  - 1. Level, plumb, and tighten installation with leveling device.
  - 2. Secure pilaster shoes in position.
  - 3. Secure headrail to pilasters with not less than two fasteners. Secure headrail to walls using brackets.
  - 4. Set tops of doors parallel with overhead brace when doors are in closed position.
- C. No evidence of drilling, cutting, or patching shall be visible in the finished work.
- D. Clearance at vertical edges of doors shall be uniform top to bottom and shall not exceed 1/4 inch.
- E. Finished surfaces shall be cleaned after installation and left free of imperfections.
- F. Authorized factory installers to be utilized.

**3.3 ADJUSTING**

- A. Adjust and lubricate hardware for proper operation after installation.
  - 1. Set hinges on inward swing doors to hold doors open approximately 30 degree angle from closed position when unlatched.
  - 2. Set hinges on outward swing doors to hold doors open approximately 10 degrees from closed position.
  - 3. Perform final adjustments to leveling devices and hardware.
  - 4. Adjust and align door hardware for uniform 3/16 inch clearance at vertical edges.
- B. Replace damaged material with new materials matching undamaged at no additional cost to Owner.

**3.4 CLEANING**

- A. Clean exposed surfaces of partition systems using materials and methods recommended by manufacturer, and provide protection as necessary to prevent damage during remainder of construction period.

**- END OF SECTION -**

**- SECTION 10 2226 -**

**ACCORDION FOLDING PARTITIONS**

---

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Manually operated, accordion folding partitions.

**1.3 RELATED SECTIONS**

- A. Section 01 74 19 "Materials Recycling & Waste Management".
- B. Section 01 81 13 "LEED Certification Requirements".
- C. Section 05 5000 "Metal Fabrications" for supports that attach supporting tracks to overhead structural system.
- D. Section 09 2900 "Gypsum Board Assemblies" for fire-rated assemblies and sound barrier construction above the ceiling at track.

**1.4 DEFINITIONS**

- A. ADA-ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities."
- B. NIC: Noise Isolation Class.
- C. NRC: Noise Reduction Coefficient.
- D. STC: Sound Transmission Class.

**1.5 PERFORMANCE REQUIREMENTS**

- A. Seismic Performance: Operable panel partitions shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.



1. The term "withstand" means "the panels will remain in place without separation of any parts from the system when subjected to the seismic forces specified."
- B. Acoustical Performance: Provide operable panel partitions tested by a qualified testing agency for the following acoustical properties according to test methods indicated:
  1. Sound-Transmission Requirements: Operable panel partition assembly tested for laboratory sound-transmission loss performance according to ASTM E 90, determined by ASTM E 413, and rated for not less than the STC indicated.
  2. Noise-Reduction Requirements: Operable panel partition assembly, identical to partition tested for STC, tested for sound-absorption performance according to ASTM C 423, and rated for not less than the NRC indicated.

## 1.6 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include plans, elevations, sections, details and attachments to other work.
  1. For installed products indicated to comply with design loads, include structural analysis data for attachments, signed and sealed by the qualified professional engineer responsible for their preparation.
  2. Indicate storage and operating clearances. Indicate location and installation requirements for hardware and track, blocking, and direction of travel.
- C. Samples for Initial Selection: For each type of exposed material, finish, covering, or facing indicated.
  1. Include similar Samples of accessories involving color selection.
- D. Samples for Verification: For each type of exposed material, finish, covering, or facing indicated, prepared on Samples of size indicated below:
  1. Textile: Full width by not less than **36-inch- (914-mm-)** long section of fabric from dye lot to be used for the Work, with specified treatments applied. Show complete pattern repeat.
  2. Panel Facing Material: Manufacturer's standard-size unit, not less than **3 inches (75 mm)** square.
  3. Panel Edge Material: Not less than **3 inches (75 mm)** long.
- E. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
  1. Suspended ceiling components.
  2. Structural members to which suspension systems will be attached.
  3. Size and location of initial access modules for acoustical tile.
  4. Items penetrating finished ceiling, including the following:
    - a. Lighting fixtures.
    - b. HVAC ductwork, outlets, and inlets.
    - c. Speakers.
    - d. Sprinklers.
    - e. Smoke detectors.
    - f. Access panels.

- F. Qualification Data: For qualified Installer.
- G. Seismic Qualification Certificates: For operable panel partitions, accessories, and components, from manufacturer.
  - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- H. Product Certificates: For each type of operable panel partition, from manufacturer.
- I. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each operable panel partition.
- J. Operation and Maintenance Data: For operable panel partitions to include in maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:
  - 1. Panel finish facings and finishes for exposed trim and accessories. Include precautions for cleaning materials and methods that could be detrimental to finishes and performance.
  - 2. Seals, hardware, track, carriers, and other operating components.
- K. Warranty: Sample of special warranty
- L. LEED Submittals:
  - 1. Certificates for Credit MR 7: Chain-of-custody certificates certifying that operable panel partitions comply with forest certification requirements. Include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.
  - 2. Product Data for Credit EQ 4.4: For each composite wood product used in operable panel partitions, documentation indicating that product contains no urea formaldehyde.

## 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Forest Certification: Fabricate products with wood, wood veneers, and wood-based panel products produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
- C. Fire-Test-Response Characteristics: Provide panels with finishes meeting one of the following as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
  - 1. Surface-Burning Characteristics: As determined by testing per ASTM E 84.
    - a. Flame-Spread Index: 26 to 75.
    - b. Smoke-Developed Index: 450 or less.
  - 2. Fire Growth Contribution: Meeting acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protectively package and sequence panels in order for installation. Clearly mark packages and panels with numbering system used on Shop Drawings. Do not use permanent markings on panels.

## 1.9 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of operable panel partition openings by field measurements before fabrication.

## 1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of operable panel partitions that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Faulty operation of operable panel partitions.
    - b. Deterioration of metals, metal finishes, and other materials beyond normal wear.
  - 2. Warranty Period: Two years from date of Substantial Completion.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. Basis-of-Design Product: The design for accordion folding partitions is based on Soundmaster 12 Series manufactured by Modernfold, Inc., A DORMA Group Company, New Castle, IN, tel: (800) 869-9685, [www.modernfold.com](http://www.modernfold.com). Subject to compliance with requirements, provide the named product or a comparable product by one of the following:
  - 1. FoIDoor, Holcomb & Hoke Mfg. Co., Inc.
  - 2. Hufcor.
  - 3. Panelfold Inc.

## 2.2 ACCORDION FOLDING PARTITIONS

- A. Construction: Provide pantograph or hinged-section, accordion folding frame supporting acoustical core and decorative facing/cover, supported by overhead suspension system, designed for horizontal extension and retraction, and reinforced for hardware attachment. Securely attach sound-insulating core and facing/cover to frame. Fabricate partitions rigid; level; plumb; aligned, with tight joints and uniform appearance; and free of deformation and surface and finish irregularities.
  - 1. STC: Not less than 40.
- B. Dimensions: Fabricate accordion folding partitions, from manufacturer's standard sizes, to form an assembled system of dimensions indicated on Drawings and verified by field measurements.
- C. Trim: Manufacturer's standard trim with decorative, protective finish.

## ACCORDION FOLDING PARTITIONS

- D. Tiebacks: As required to maintain accordion folding partitions in stacked position.

### 2.3 SEALS AND POSTS

- A. General: Provide types of acoustical seals and posts indicated that produce accordion folding partitions complying with acoustical performance requirements and the following:
  - 1. Seals and posts made from materials and in profiles that minimize sound leakage.
  - 2. Seals and posts fitting tight at contact surfaces and sealing continuously between adjacent accordion folding partitions and between partition perimeter and adjacent surfaces, when accordion folding partition is extended and closed.
- B. Perimeter Seals and Closures: Manufacturer's standard vinyl or neoprene vertical seals, horizontal top and bottom seals, and closures for lead posts and jambs.
- C. Perimeter Seals and Closures: Provide manufacturer's standard vinyl, or neoprene, or woven silica vertical seals, horizontal top and bottom seals, and closures identical to products tested for fire rating indicated and forming an effective smoke and draft seal.
- D. Posts and Jambs: Steel or aluminum; formed with deep-nesting and interlocking interfaces and fabricated to ensure rigidity for accordion folding partition.

### 2.4 HARDWARE

- A. Hardware: Manufacturer's standard manually operated pulls and latches as required to operate accordion folding partitions and as follows; with decorative, protective finish:

### 2.5 FINISH FACING

- A. General: Provide finish facings that comply with indicated fire-test-response characteristics; factory attached or applied to accordion folding partitions over acoustical core with appropriate backing, using concealed fasteners; designed to be field replaceable.

### 2.6 SUSPENSION SYSTEMS

- A. Suspension Tracks: Steel or aluminum mounted directly to overhead structural support with adjustable steel hanger rods for overhead support, designed for type of operation, size, and weight of operable panel partition indicated. Size track to support partition operation and storage without damage to suspension system, operable panel partitions, or adjacent construction. Limit track deflection to no more than **0.10 inch (2.54 mm)** between bracket supports. Provide a continuous system of track sections and accessories to accommodate configuration and layout indicated for partition operation and storage.
  - 1. Panel Guide: Aluminum; finished with factory-applied, decorative, protective finish.
  - 2. Head Closure Trim: As required for acoustical performance with factory-applied, decorative, protective finish.
- B. Carriers: Trolley system as required for configuration type, size, and weight of partition and for easy operation; with ball-bearing wheels.
- D. Aluminum Finish: Mill finish or manufacturer's standard, factory-applied, decorative finish unless otherwise indicated.

- E. Steel Finish: Manufacturer's standard, factory-applied, corrosion-resistant, protective coating unless otherwise indicated.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine flooring, structural support, and opening, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of operable panel partitions.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION**

- A. General: Comply with ASTM E 557 except as otherwise required by operable panel partition manufacturer's written installation instructions.
- B. Install operable panel partitions and accessories after other finishing operations, including painting, have been completed.
- C. Install panels from marked packages in numbered sequence indicated on Shop Drawings.
- D. Broken, cracked, chipped, deformed, or unmatched panels are not acceptable.
- E. Broken, cracked, deformed, or unmatched gasketing or gasketing with gaps at butted ends is not acceptable.

### **3.3 ADJUSTING**

- A. Adjust operable panel partitions to operate smoothly, without warping or binding. Lubricate hardware and other moving parts.

### **3.4 FIELD QUALITY CONTROL**

- A. Light-Leakage Test: Illuminate one side of partition installation and observe vertical joints and top and bottom seals for voids; adjust partitions for acceptable fit.
- B. NIC Testing: Owner will engage a qualified testing agency to perform tests and inspections.
- C. Testing Methodology: Perform testing of installed operable panel partition for noise isolation according to ASTM E 336, determined by ASTM E 413, and rated for not less than NIC indicated. Adjust and fit partitions to comply with NIC test method requirements.
- D. Testing Extent: Testing agency shall randomly select one operable panel partition installation(s) for testing per room.
- E. Repair or replace operable panel partitions that do not comply with requirements.

- F. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of repaired, replaced, or additional work with specified requirements.
- G. Prepare test and inspection reports.

**3.5 CLEANING**

- A. Clean soiled surfaces of operable panel partitions to remove dust, loose fibers, fingerprints, adhesives, and other foreign materials according to manufacturer's written instructions.

**3.6 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain operable panel partitions.

**- END OF SECTION -**



## **- SECTION 10 2600 -**

# **WALL & DOOR PROTECTION**

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## **PART 1 - GENERAL**

### **1.1 RELATED DOCUMENTS**

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

### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Wall guards.
  - 2. Corner guards.
  - 3. Impact-resistant wall coverings.
  - 4. Door protection systems.
- B. Related Sections:
  - 1. Section 01 74 19 "Materials Recycling & Waste Management".
  - 2. Section 01 81 13 "LEED Certification Requirements".
  - 3. Section 05 5000 "Metal Fabrications" for metal angle corner guards and pipe guards.
  - 4. Section 08 7111 "Door Hardware" for metal armor, kick, mop, and push plates.

### **1.3 PERFORMANCE REQUIREMENTS**

- A. Structural Performance: Provide handrails capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
  - 1. Uniform load of 50 lbf/ft. (0.73 kN/m) applied in any direction.
  - 2. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
  - 3. Uniform and concentrated loads need not be assumed to act concurrently.

### **1.4 SUBMITTALS**

- A. Product Data: Include construction details, material descriptions, impact strength, fire-test-response characteristics, dimensions of individual components and profiles, and finishes for each impact-resistant wall protection unit.



- B. LEED Submittals:
  - 1. Certificates for Credit MR 7: Chain-of-custody certificates certifying that wood rails comply with forest certification requirements. Include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.
    - a. Include statement indicating costs for each certified wood product.
  - 2. Product Data for Credit EQ 4.1: For adhesives, including printed statement of VOC content.
  - 3. Product Data for Credit EQ 4.4: For particleboard, documentation indicating that products contain no urea formaldehyde.
- C. Shop Drawings: For each impact-resistant wall protection unit showing locations and extent. Include sections, details, and attachments to other work.
  - 1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- D. Samples for Initial Selection: For each type of impact-resistant wall protection unit indicated.
  - 1. Include similar Samples of accent strips and accessories involving color selection.
- E. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
  - 1. Wall and Corner Guards: 12 inches (300 mm) long. Include examples of joinery, corners, end caps, top caps, and field splices.
  - 2. Impact-Resistant Wall Covering: 6 by 6 inches (150 by 150 mm) square.
- F. Material Certificates: For each impact-resistant plastic material, from manufacturer.
- G. Material Test Reports: For each impact-resistant plastic material.
- H. Maintenance Data: For each impact-resistant wall protection unit to include in maintenance manuals.
  - 1. Include recommended methods and frequency of maintenance for maintaining optimum condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to plastic finishes and performance.
- I. Warranty: Sample of special warranty.

## 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Source Limitations: Obtain impact-resistant wall protection units from single source from single manufacturer.

- C. Product Options: Drawings indicate size, profiles, and dimensional requirements of impact-resistant wall protection units and are based on the specific system indicated. Refer to Division 01 Section "Quality Requirements."
  - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
- D. Surface-Burning Characteristics: Provide impact-resistant, plastic wall protection units with surface-burning characteristics as determined by testing identical products per ASTM E 84, NFPA 255, or UL 723 by UL or another qualified testing agency.
- E. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.
- F. Preinstallation Conference: Conduct conference at Project site.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store impact-resistant wall protection units in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
  - 1. Maintain room temperature within storage area at not less than 70 deg F (21 deg C) during the period plastic materials are stored.
  - 2. Keep plastic sheet material out of direct sunlight.
  - 3. Store plastic wall protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F (21 deg C).
    - a. Store corner-guard covers in a vertical position.
    - b. Store wall-guard covers in a horizontal position.

## 1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install impact-resistant wall protection units until building is enclosed and weatherproof, wet work is complete and dry, and HVAC system is operating and maintaining temperature at 70 deg F (21 deg C) for not less than 72 hours before beginning installation and for the remainder of the construction period.

## 1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of impact-resistant wall protection units that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures.
    - b. Deterioration of plastic and other materials beyond normal use.
  - 2. Warranty Period: Five years from date of Substantial Completion.

## 1.9 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Wall-Guard Covers: Full-size plastic covers of maximum length equal to 2 percent of each type, color, and texture of units installed, but no fewer than two, 8-foot- (2.4-m-) long units.
  - 2. Corner-Guard Covers: Full-size plastic covers of maximum length equal to 2 percent of each type, color, and texture of units installed, but no fewer than two, 4-foot- (1.2-m-) long units.
- B. Include mounting and accessory components. Replacement materials shall be from same production run as installed units.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. PVC Plastic: ASTM D 1784, Class 1, textured, chemical- and stain-resistant, high-impact-resistant PVC or acrylic-modified vinyl plastic with integral color throughout; extruded and sheet material, thickness as indicated.
  - 1. Impact Resistance: Minimum 30.2 ft-lbf/in. (1612 J/m) of notch when tested according to ASTM D 256, Test Method A.
  - 2. Chemical and Stain Resistance: Tested according to ASTM D 543.
  - 3. Self-extinguishing when tested according to ASTM D 635.
  - 4. Flame-Spread Index: 25 or less.
  - 5. Smoke-Developed Index: 450 or less.
- B. Aluminum Extrusions: Alloy and temper recommended by manufacturer for type of use and finish indicated, but with not less than strength and durability properties specified in **ASTM B 221 (ASTM B 221M)** for Alloy 6063-T5.
- C. Stainless-Steel Sheet: ASTM A 240/A 240M.
- D. Brass: ASTM B 249/B 249M for extruded shapes and ASTM B 36/B 36 M for sheet.
- E. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.
- F. Adhesive: As recommended by impact-resistant plastic wall protection manufacturer and with a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 2.2 WALL GUARDS

- A. Wall Guard (Chair rail): Assembly consisting of continuous snap-on cover installed over continuous retainer.
1. Basis-of-Design Product: Subject to compliance with requirements, provide 500 Wall Guard manufactured by IPC Door and Wall Protection Systems, a Division of InPro Corporation, Muskego, WI, tele: (800) 222-5556, www.inprocorp.com or comparable product by one of the following:
    - a. Construction Specialties, Inc.
    - b. Korogard Wall Protection Systems; a division of RJF International Corporation.
  2. Cover: Extruded rigid plastic, minimum 0.080-inch (2.0-mm) wall thickness; as follows:
    - a. Profile: Rounded bullnose profile, nominal 3 inches high by 1 inch deep (76 mm high by 25 mm deep).
    - b. Color and Texture: Clam Shell, pebblette texture.
  3. Retainer: Minimum 0.060-inch- (1.5-mm-) thick, one-piece, extruded aluminum.
  4. End Caps and Corners: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.
  5. Accessories: Concealed splices and mounting hardware.
  6. Mounting: Surface mounted directly to wall.

## 2.3 CORNER GUARDS

- A. Surface-Mounted, Resilient, Plastic Corner Guards: Assembly consisting of snap-on plastic cover installed over continuous retainer; including mounting hardware; fabricated with 90- or 135-degree turn to match wall condition.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Surface Mount Corner Guards 150 as manufactured by IPC Door and Wall Protection Systems, a Division of InPro Corporation, Muskego, WI, tele: (800) 222-5556, www.inprocorp.com or comparable product by one of the following:
    - a. American Floor Products Co., Inc.
    - b. Arden Architectural Specialties, Inc.
    - c. Balco, Inc.
    - d. Construction Specialties, Inc.
    - e. IPC Door and Wall Protection Systems; Division of InPro Corporation.
    - f. Korogard Wall Protection Systems; a division of RJF International Corporation.
    - g. Musson Rubber Company.
    - h. Pawling Corporation.
    - i. Tepromark International, Inc.
    - j. WallGuard.com.
  2. Cover: Extruded rigid plastic, minimum 0.080-inch (2.0-mm) wall thickness; as follows:
    - a. Profile: Nominal 3-inch- (75-mm-) long leg and 1/4-inch (6-mm) corner radius.
    - b. Height: As indicated on drawings.
    - c. Color and Texture: As selected by Architect from manufacturer's full range.
  3. Retainer: Minimum 0.060-inch- (1.5-mm-) thick, one-piece, extruded aluminum.
  4. Retainer Clips: Manufacturer's standard impact-absorbing clips.

5. Top and Bottom Caps: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.
- B. Surface-Mounted, Metal Corner Guards: Fabricated from one-piece, formed or extruded metal with formed edges; with 90-degree turn to match wall condition.
1. Basis-of-Design Product: Subject to compliance with requirements, provide SS-CGFM Stainless Steel Corner Guards as manufactured by IPC Door and Wall Protection Systems, a Division of InPro Corporation, Muskego, WI, tele: (800) 222-5556, www.inprocorp.com or comparable product by one of the following:
    - a. Arden Architectural Specialties, Inc.
    - b. Balco, Inc.
    - c. Construction Specialties, Inc.
    - d. Pawling Corporation.
  2. Material: Stainless steel, Type 430.
    - a. Thickness: Minimum 16 gauge (0.060 inch).
    - b. Finish: Directional satin, No. 4.
  3. Wing Size: Nominal 1-1/2 by 1-1/2 inches (38 by 38 mm).
  4. Corner Radius: 1/8 inch (3 mm).
  5. Mounting: Flat-head, countersunk screws through factory-drilled mounting holes.

## 2.4 END-WALL GUARDS

- A. Surface-Mounted, Resilient, Plastic End-Wall Guard: Assembly consisting of snap-on plastic cover installed over continuous retainer; including mounting hardware.
1. Basis-of-Design Product: Subject to compliance with requirements, provide 502 End Guard manufactured by IPC Door and Wall Protection Systems, a Division of InPro Corporation, Muskego, WI, tele: (800) 222-5556, www.inprocorp.com or comparable product by one of the following:
    - a. American Floor Products Co., Inc.
    - b. Arden Architectural Specialties, Inc.
    - c. Balco, Inc.
    - d. Construction Specialties, Inc.
    - e. Korogard Wall Protection Systems; a division of RJF International Corporation.
    - f. Pawling Corporation.
    - g. WallGuard.com.
  2. Cover: Extruded rigid plastic, minimum 0.078-inch (2.0-mm) wall thickness; as follows: [
    - a. Profile: Nominal 3-inch- (75-mm-) long leg and 1/4-inch (6-mm) corner radius.
    - b. Height: As indicated on Drawings.
    - c. Color and Texture: As selected by Architect from manufacturer's full range.
  3. Retainer: Minimum 0.060-inch- (1.5-mm-) thick, one-piece, extruded aluminum.
  4. Top and Bottom Caps: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.

## 2.5 IMPACT-RESISTANT WALL COVERINGS

- A. Impact-Resistant Sheet Wall Covering: Fabricated from plastic sheet wall-covering material.

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1. Basis-of-Design Product: Subject to compliance with requirements, provide Sanparrel Rigid Vinyl Sheet, manufactured by IPC Door and Wall Protection Systems, a Division of InPro Corporation, Muskego, WI, tele: (800) 222-5556, www.inprocorp.com or comparable product by one of the following:
  - a. Arden Architectural Specialties, Inc.
  - b. Balco, Inc.
  - c. Construction Specialties, Inc.
  - d. Korogard Wall Protection Systems; a division of RJF International Corporation.
  - e. Pawling Corporation.
  - f. Tepromark International, Inc.
  - g. WallGuard.com.
2. Size: 36 by 96 inches (914 by 2438 mm) for sheet.
3. Sheet Thickness: 0.040 inch (1.0 mm).
4. Color and Texture: Clam shell.
5. Height: Wainscot.
6. Trim and Joint Moldings: Extruded rigid plastic that matches sheet wall covering color.
7. Mounting: Adhesive.

## 2.6 FABRICATION

- A. Fabricate impact-resistant wall protection units to comply with requirements indicated for design, dimensions, and member sizes, including thicknesses of components.
- B. Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.
- C. Fabricate components with tight seams and joints with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

## 2.7 METAL FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
  1. Remove tool and die marks and stretch lines, or blend into finish.
  2. Grind and polish surfaces to produce uniform finish, free of cross scratches.
  3. Run grain of directional finishes with long dimension of each piece.
  4. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
- B. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances, fire rating, and other conditions affecting performance of work.
- B. Examine walls to which impact-resistant wall protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.
  - 1. For impact-resistant wall protection units attached with adhesive or foam tape, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Complete finishing operations, including painting, before installing impact-resistant wall protection system components.
- B. Before installation, clean substrate to remove dust, debris, and loose particles.

### **3.3 INSTALLATION**

- A. General: Install impact-resistant wall protection units level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
  - 1. Install impact-resistant wall protection units in locations and at mounting heights indicated on Drawings or, if not indicated, at heights indicated below:
    - a. Chair Rails: Height to match window sill height.
  - 2. Provide splices, mounting hardware, anchors, and other accessories required for a complete installation.
    - a. Provide anchoring devices to withstand imposed loads.
    - b. Where splices occur in horizontal runs of more than 20 feet (6.1 m), splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 inches (305 mm).
    - c. Adjust end and top caps as required to ensure tight seams.
- B. Impact-Resistant Wall Covering: Install top and edge moldings, corners, and divider bars as required for a complete installation.

### **3.4 CLEANING**

- A. Immediately after completion of installation, clean plastic covers and accessories using a standard, ammonia-based, household cleaning agent.

- B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

**- END OF SECTION -**





## - SECTION 10 2800 -

# TOILET & BATH ACCESSORIES

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## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Toilet and bath accessories.
  - 2. Janitor Room accessories.
  - 3. Childcare accessories.
  - 4. Hand Dryers.

### 1.3 RELATED SECTIONS

- A. Section 06 1053 "Miscellaneous Carpentry" for associated wood blocking to support bathroom accessories.
- B. Section 10 2113 "Toilet Compartments" for substrate to install accessories specified in this section.

### 1.4 SUBMITTALS

- A. General: Submit in accordance with Section 01 3219.
- B. Product Data: Submit manufacturer's catalog cut sheets, and data sheets.
- C. Shop Drawings: Submit setting drawings, templates, instructions, and directions for installing anchorage devices and cut-out requirements in other work.
- D. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required. Use designations indicated in the Toilet and Bath Accessory Schedule and room designations indicated on Drawings in product schedule

- E. Submit following Informational Submittals:
  - 1. Certifications specified in Quality Assurance article.
  - 2. Manufacturer's instructions.
- F. Closeout Submittals:
  - 1. Submit under provisions of Section 01 7700.
  - 2. Maintenance data.

### **1.5 QUALITY ASSURANCE**

- A. Regulatory Requirements: Conform to ANSI A117.1 or local code if more stringent requirements are applicable for installing work for accessibility to handicapped.
- B. Certification: Provide verification of grab bar strength and installation.

### **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Pack accessories individually with protective wrappings.

### **1.7 KEYING**

- A. Keys: Provide universal keys for internal access to accessories for servicing and re-supplying. Provide minimum of six keys to Owner's representative. Key "coin boxes" separately from dispensing units; furnish six separate keys.

### **1.8 COORDINATION**

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by disabled persons, proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

### **1.9 WARRANTY**

- A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Manufacturer's Mirror Warranty: Written warranty, executed by mirror manufacturer agreeing to replace mirrors that develop visible silver spoilage defects within minimum warranty period indicated.
  - a. Other warranty periods are available from some manufacturers. Modify warranty period below to suit products selected.
    - 1) Minimum Warranty Period: 15 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Acceptable Manufacturers, Toilet Accessories:
1. A&J Washroom Accessories, Inc.
  2. Bobrick Washroom Equipment, Inc., North Hollywood, CA.
  3. American Specialties, Inc., Yonkers, NY.
  4. Bradley Corporation, Menomonee Falls, WI.
  5. Georgia Pacific.
- B. For most items, Bobrick accessories are specified, but items of equivalent design, sightlines, construction, size, function and capacity by manufacturers listed in paragraph above are also acceptable.
1. Accessories as noted on plans to be reinstalled shall be installed in accordance with this section and keyed alike. All other accessories shall be furnished and installed.
- C. Acceptable Manufacturers, Under-lavatory Guards:
1. Brocar Products, Inc.
  2. Plumberex Specialty Products
  3. Truebro, Inc

### 2.2 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, with No. 4 finish (satin), in 0.0312-inch (0.8-mm) minimum nominal thickness, unless otherwise indicated.
1. Tubing: ASTM A269, UNS S30400.
- B. Sheet Steel: ASTM A 366/A 366M, 20 gage minimum cold rolled, commercial quality, 0.0359-inch (0.9-mm) minimum nominal thickness; surface preparation and metal pretreatment as required for applied finish:
1. Galvanized steel: ASTM A653, G60 zinc coating.
- C. Aluminum Casting: ASTM B85.
- D. Brass: ASTM B 19, leaded and unleaded flat products; ASTM B 16 (ASTM B 16M), rods, shapes, forgings, and flat products with finished edges; ASTM B 30, castings.
- E. Galvanized Steel Sheet: ASTM A 653/A 653M, G60 (Z180).
- F. Chromium Plating: ASTM B 456, Service Condition Number SC 2 (moderate service), nickel plus chromium electrodeposited on base metal.
- G. Baked-Enamel Finish: Factory-applied, gloss-white, baked-acrylic-enamel coating.
- H. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

- I. Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel complying with ASTM A123 where concealed; theft-proof design at exposed conditions.
- J. Expansion Shields: Type as recommended by accessory manufacturer for component and substrate.
- K. Sanitary Sealant:
  - 1. One part silicone conforming to FS-TT-S-001543, FDA Regulation 21 CFR177.2600, and FDA Food Additive Regulation 121.2514.
  - 2. Color: White
  - 3. Acceptable Products:
    - a. No. 786 Silicone Rubber Sealant, Dow Corning Corporation, Midland, MI.
    - b. SCS1700, General Electric Silicones, Waterford, NY.

### 2.3 FABRICATION

- A. Weld and grind smooth joints of fabricated components.
- B. Form exposed surfaces from single sheet of stock, free of joints.
- C. Form surfaces flat without distortion. Maintain flat surfaces without scratches or dents.
- D. Back paint components where contact is made with building finishes to prevent electrolysis.
- E. Shop assemble components and package complete with fasteners, anchors, and fittings.
- F. Provide anchor plates, adapters, and anchor components necessary for installation.
- G. General: Names or labels are not permitted on exposed faces of accessories. On interior surface not exposed to view or on back surface of each accessory, provide printed, waterproof label or stamped nameplate indicating manufacturer's name and product model number.
- H. Surface-Mounted Toilet Accessories: Unless otherwise indicated, fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with continuous stainless-steel hinge. Provide concealed anchorage where possible.
- I. Recessed Toilet Accessories: Unless otherwise indicated, fabricate units of all-welded construction, without mitered corners. Hang doors and access panels with full-length, stainless-steel hinge. Provide anchorage that is fully concealed when unit is closed
- J. ADA Compliant Toilet Tissue Dispenser: Unit shall be continuous flow type. Dispensers that control delivery shall not be used per 1115.B.9.3.
  - 1. Toilet tissue dispenser shall not project more than 3" from face of wall when located below grab bar.
  - 2. Mounting: Surface mounted with concealed anchorage.

- K. Recessed Convertible Paper Towel Dispenser / Waste Receptacle:
1. Stainless steel, combination unit fabricated for nominal 4 inch recess depth with continuous seamless 1 inch wide wall flange. Provide towel compartment in upper portion of unit designed to dispense not less than 600 C-fold or 800 multifold paper towels, upper-panel door with continuous piano hinge and tumbler lock. Waste receptacle, 8 inch semi-recessed, in lower portion of unit provided with reusable, heavy-duty vinyl liner, minimum 12 gallon capacity, secured in place by tumbler lock.
- L. Grab Bar: Provide stainless-steel grab bar complying with the following:
1. Stainless-Steel Nominal Thickness: Minimum **0.05 inch**.
  2. Mounting: Concealed with manufacturer's standard flanges and anchors.
  3. Gripping Surfaces: Smooth, satin finish.
  4. Outside Diameter: 1-1/2 inches for heavy-duty applications.
    - a. Secure grab bars: Provide with closure plate of Type 304 (18-8), 11 gage stainless steel.
  5. Length: See schedule at the end of this section.
- M. Recessed Soap Dispenser: The unit is constructed of type-304 stainless steel with satin finish. Front of dispenser shall have same degree of arc and match other accessories in the restroom. Flange will be drawn, 20 gauge (0.9-mm), one piece, seamless construction. Front of soap dispenser will have covered, molded plastic soap vessel attached to back, be equipped with a concealed locking device, and pull out for filing and maintenance. Corrosion-resistant valve will dispense E4-rated antibacterial soaps (active ingredient PCMX or Triclosan), iodine-based surgical soaps, or alcohol-based antiseptic solutions, as well as liquid and lotion soaps, and synthetic detergents. Valve to be operable with one hand and require less than 5 pounds of force to comply with ADA Accessibility Guidelines (ADAAG). Capacity: 34 fluid ounces (1.48 liters).
- N. Lavatory Mounted Soap Dispenser: Model 0332 manufactured by American Specialties, Inc. Lavatory mounted Soap Dispenser shall dispense 34 oz. (1.0 liter) of liquid and lotion soaps, synthetic detergents and antibacterial soaps containing PCMX and/or Triclosan. Dispenser stem and 6 inch (152 mm) long spout shall be stainless steel with rubber "duck bill" check valves and an O-ring seal. Valve body, internal parts, basin nut, threaded shank and globe adapter shall be molded plastic. Spring, escutcheon washer, stem retainer collar and screw shall be stainless steel. Escutcheon shall be chrome plated brass. Soap container shall be translucent, shatter-resistant polyethylene. Vandal-resistant spout shall rotate 360 degrees without damage to unit. Valve operation shall comply with ADA Accessibility Guidelines by requiring no more than 5 lbs. of pressure to actuate without grasping or twisting by operator.
- O. Recessed Toilet Seat Cover Dispenser, Sanitary Napkin Disposal and Toilet Tissue Dispenser: This unit mounts flush against wall to allow clearance for grab bar. The unit is constructed of type-304 stainless steel with satin finish and all-welded construction. Flanges shall be 22-gauge (0.9 mm), drawn and beveled, one-piece, seamless construction. Unit shall mount against side of wall of barrier-free toilet compartment to allow clearance for grab bar access across front of unit. Door shall be 18-gauge (1.2 mm) one-piece seamless construction, secured to cabinet with full-length stainless steel piano hinge and be equipped with a tumbler lock. Self-closing disposal panel door shall be secured to door with spring-loaded, full-length stainless steel piano hinge and be equipped with international graphic symbol identifying usage. Disposal shall be furnished with a removable, leak-proof, molded polyethylene receptacle with a capacity of 0.8 gallons (3.0 liters). Toilet seat cover dispenser shall be equipped with plastic

- sight barrier and holds 1000 paper toilet seat covers. Unit shall be equipped with four theft-resistant, high-impact polyethylene toilet tissue spindles that hold standard core rolls up to 5-1/4 inch (135-mm) diameter (1800 sheets).
- P. Robe Hook: Double-prong unit. Flange and support arm, 18-8 S, type 304, 22-gauge stainless steel. Concealed, 16-gauge stainless steel mounting bracket. All-welded construction. Secured to wall plate with a stainless steel setscrew, concealed wall plate, 18-8 S, type 304, 16-gauge stainless steel. Cap, 18-8 S, type 304, 10-gauge stainless steel, welded to the support arm.
- Q. Coat Hook with Bumper: Coat hook and bumper shall be constructed of solid aluminum with satin finish. Hard rubber bumper shall be secured to coat hook with a drive-screw. Unit shall be equipped with four countersunk mounting screw holes for attachment to wall.
- R. Surface-Mounted Utility Hook: Surface-mounted utility hook shall be type 304 stainless steel with satin finish. Flange and support arm shall be 22 gauge and equipped with concealed, 16 gauge mounting bracket that is secured to a concealed, 16 gauge wall plate with stainless steel setscrew. Cap shall be 10 gauge, welded to the support arm.
- S. Channel Framed Mirrors with shelf: Mirrors shall have one-piece, polished stainless steel 1/2 inch x 1/2 inch x 3/8 inch (13 x 13 x 13 mm) channel frame. Mirror frame shall have 90 degree uniform corners; open or uneven mitered corners are not acceptable. Shelf shall be type 304, 22-gauge stainless steel with satin finish and shall have 3/8 inch return edges on front and sides with return edge hemmed. Shelf shall be welded to mirror frame and reinforced by concealed stainless steel brackets. Mirrors shall be No. 1 quality, 1/4 inch (6-mm) float/plate glass. All mirror edges shall be protected by filler strips. Mirror back shall be protected by full-size shock-absorbing, water-resistant, non-abrasive 3/16 inch (5-mm) thick polyethylene padding. Galvanized steel back with formed edges for additional strength shall have integral hanging brackets for mounting on concealed one-piece rectangular wall hanger(s). Mirrors shall be secured to hanger with concealed Phillips head locking setscrews in bottom of frame.
- T. Channel Framed Mirrors: Mirrors shall have one-piece, polished stainless steel 1/2 inch x 1/2 inch x 3/8 inch (13 x 13 x 13 mm) channel frame. Mirror frame shall have 90 degree uniform corners; open or uneven mitered corners are not acceptable. Mirrors shall be No. 1 quality, 1/4 inch (6-mm) float/plate glass. All mirror edges shall be protected by filler strips. Mirror back shall be protected by full-size shock-absorbing, water-resistant, non-abrasive 3/16 inch (5-mm) thick polyethylene padding. Galvanized steel back with formed edges for additional strength shall have integral hanging brackets for mounting on concealed one-piece rectangular wall hanger(s). Mirrors shall be secured to hanger with concealed Phillips head locking setscrews in bottom of frame.
- U. Partition-Mounted Toilet Seat Cover Dispenser, Sanitary Napkin Disposal and Toilet Tissue Dispenser: The unit is partition mounted and toilet tissue dispenser shall be constructed of type-304 stainless steel with satin finish and all-welded construction. Flanges shall be 22-gauge (0.9 mm), drawn and beveled, one-piece, seamless construction. Unit shall mount in partition and serve two toilet compartments. Door shall be 18-gauge (1.2 mm) one-piece seamless construction, secured to cabinet with full-length stainless steel piano hinge and be equipped with two tumbler locks. Self-closing disposal panel door shall be secured to cabinet with spring-loaded, full-length stainless steel piano hinge, have hemmed edges and be equipped with international graphic symbol identifying usage. Napkin disposal shall be furnished with a removable, leak-proof, molded polyethylene receptacle with a capacity of 0.8 gallons (3.0 liters). Toilet-seat-cover dispenser and sanitary napkin disposal shall be serviced from one side only. Toilet seat cover dispenser shall be equipped with plastic sight barrier

**TOILET & BATH ACCESSORIES**

panel and hold 1000 paper toilet seat covers. Unit shall be equipped with four theft-resistant, high-impact polyethylene toilet tissue spindles that hold standard core rolls up to 5-1/4 inch (135-mm) diameter (1800 sheets). Spindles shall be removable from cabinet only when door is open.

- V. Partition-Mounted Toilet Seat Cover Dispenser, Sanitary Napkin Disposal and Toilet Tissue Dispenser: The unit is partition mounted and toilet tissue dispenser shall be constructed of type-304 stainless steel with satin finish and all-welded construction. Flanges shall be 22-gauge (0.9 mm), drawn and beveled, one-piece, seamless construction. Unit shall mount in partition and serve two toilet compartments. One side of unit shall mount flush against partition of barrier-free compartment to allow clearance for grab bar across front of unit. Door shall be 18-gauge (1.2 mm) one-piece seamless construction, secured to cabinet with full-length stainless steel piano hinge and be equipped with two tumbler locks. Self-closing disposal panel door shall be secured to cabinet with spring-loaded, full-length stainless steel piano hinge, have hemmed edges and be equipped with international graphic symbol identifying usage. Napkin disposal shall be furnished with a removable, leak-proof, molded polyethylene receptacle with a capacity of 0.8 gallons (3.0 liters). Toilet-seat-cover dispenser and sanitary napkin disposal shall be serviced from one side only. Toilet seat cover dispenser shall be equipped with plastic sight barrier panel and hold 1000 paper toilet seat covers. Unit shall be equipped with four theft-resistant, high-impact polyethylene toilet tissue spindles that hold standard core rolls up to 5-1/4 inch (135-mm) diameter (1800 sheets). Spindles shall be removable from cabinet only when door is open; when door is closed, removal shall require a special key provided for the concealed locking mechanism in spindles.
- W. Recessed Sanitary Napkin/Tampon Vendor Dispenser: Recessed sanitary napkin/tampon vendor shall combine two dispensing mechanisms in one cabinet to provide sanitary napkins or tampons at user's option. Door shall be furnished with metal plates indicating specified coin denomination. Unit shall be type-304 stainless steel with all-welded construction; exposed surfaces shall have satin finish. Door shall be 18 gauge (1.2mm); have 7/8" (22mm) 90° return edges; be secured to cabinet with a concealed, full-length stainless steel piano-hinge; and equipped with a stainless steel cable door-swing limiter and two tumbler locks keyed like other washroom accessories. Pull knobs shall be operable with one hand and with less than 5 pounds of force (22.2 N) to comply with barrier-free accessibility guidelines (including ADAAG in U.S.A.). Each coin box shall be equipped with a tumbler lock that is keyed differently than door locks. Unit shall not carry brand-name advertising.
1. Dispensing mechanisms shall be preset by manufacture for 25 cent operation, but shall be convertible in the field to allow the change of coin denomination without purchasing new mechanisms or removing unit from wall.
- X. Surface-Mounted Stainless Steel Shelf: Surface-mounted shelf shall be type 304 stainless steel with bright polished finish. Flanges and support arms shall be 22 gauge (0.8 mm) and equipped with concealed, 16 gauge (1.6 mm) mounting brackets that are secured to concealed 16 gauge (1.6 mm) wall plates with stainless steel setscrews. Shelf shall be 22 gauge (0.88 mm) with roll-formed edges.
- Y. Baby-Changing Station:
1. Description: Horizontal unit that opens by folding down from stored position and with child-protection strap.
    - a. Engineered to support a minimum of 250-lb (113-kg) static load when opened.
  2. Mounting: Semirecessed, with unit projecting not more than 1-5/8 inches (40 mm) from wall when closed.
  3. Operation: By pneumatic shock-absorbing mechanism.



4. Material and Finish: High-density polyethylene in manufacturer's standard color.
  5. Liner Dispenser: Built in.
- Z. Folding Shower Seat: Folding shower seat with frame constructed of type-304, satin-finish stainless steel that consists of 18-gauge (1.2mm), 1" (25mm) diameter seamless tubing. Seat shall consist of 5 handrubbed teakwood slats, each 1/2 inch thick by 3 inches wide with rounded edges. Seat shall be left- or right-hand installation in the field. Wall bracket fabricated of 16 gauge stainless steel piano hinges. Retaining bracket fabricated of 16 gauge stainless steel with positive bullet-type catch to hold seat securely in up position when not in use.
1. Shower seat shall comply with barrier-free accessibility guidelines (including ADAAG in the U.S.A.)
- AA. Shower Curtain Rod:
1. Description: 1-inch (25.4-mm) OD; fabricated from nominal 0.0375-inch- (0.95-mm-) thick stainless steel.
  2. Mounting Flanges: 1-3/8 inch diameter. Chrome-plated plastic, bright polished finish for concealed mounting.
  3. Finish: No. 4 (satin).
- BB. Shower Curtain:
1. Size: Minimum 6 inches (152 mm) wider than opening by 72 inches (1828 mm) high.
  2. Material: Vinyl, 0.008-inch- (0.2-mm-) thick, with integral antibacterial agent and flame-retardant agents.
  3. Color: As selected from manufacturer's full range.
  4. Grommets: Corrosion resistant at minimum 6 inches (152 mm) o.c. through top hem.
  5. Shower Curtain Hooks: 18-8, type 304, 0.09 inches (2 mm) diameter stainless-steel, spring wire curtain hooks with snap fasteners, sized to accommodate specified curtain rod. Provide one hook per curtain grommet.
- CC. Hand Dryer:
1. Basis-of-Design Product: Dyson Airblade, manufactured by Dyson B2B, Inc., Chicago, IL, tel: (888) DysonAB, web: [www.dysonairblade.com](http://www.dysonairblade.com)
  2. Mounting: Surface mounted.
  3. Operation: Reflective infrared sensors.
  4. Drying time: 12 seconds.
    - a. Airspeed at hands: 400 mph.
    - b. Airspeed at hands: 35,000 linear feet per minute.
  5. Filtration: HEPA filter for clean air. H13 HEPA with anti-microbial additives.
  6. Cover Materials:
    - a. Casing: Die cast aluminum casing, anti-bacterial external plastics/rubber.
    - b. Coating: Scratch-proof lacquer with anti-microbial additives.
  7. Motor: Dyson Digital Motor (DDM); Long-life, energy efficient, switch reluctance.
    - a. Motor output power: 1400 watts.
    - b. Air Hp: 1.
  8. Electrical Requirements: 110/120v, 60 Hz, AC. Amperage: 15 amp dedicated circuit.
  9. Dimensions: 25.38 inches high x 12.25 inches wide x 10 inches deep.

**2.4 FACTORY FINISHING**

- A. Galvanizing After Fabrication: ASTM A123, 1.25 ounce per square yard.
- B. Shop Primed Ferrous Metals: Pretreat and clean, spray apply one coat primer and bake.
- C. Stainless Steel: No. 4 satin luster finish.

**2.5 UNDERLAVATORY GUARDS**

- A. Basis-of-Design Product: The design for accessories is based on products indicated. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:
  - 1. Plumberex Specialty Products, Inc.
  - 2. TCI Products.
  - 3. Truebro, Inc.
- B. Underlavatory Guard:
  - 1. Description: Insulating pipe covering for supply and drain piping assemblies that prevent direct contact with and burns from piping, and allow service access without removing coverings.
  - 2. Material and Finish: Antimicrobial, molded-plastic, white.

**PART 3 - EXECUTION****3.1 EXAMINATION**

- A. Examine conditions and proceed with Work when substrates are ready.
- B. Verify that site conditions are ready to receive work and dimensions are as indicated on shop drawings and instructed by manufacturer.
- C. Check openings for plumbness of blocking and frames.
- D. Beginning of installation means acceptance of existing conditions.

**3.2 PREPARATION**

- A. Deliver inserts and rough-in frames to site at appropriate time for installation.
- B. Provide templates and rough-in measurements as required.
- C. Verify exact location of accessories for installation.

- D. Protect adjacent or adjoining finished surfaces and work from damage during installation.
- E. Coordinate work with placement of wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.
- F. Supply rough-in data in sufficient time to be built into other work.
- G. Do not install accessories until room finishes are completed.

### 3.3 INSTALLATION

- A. Install in accordance Section 01400 and approved shop drawings.
- B. Install plumb, level, and securely anchored to substrate.
- C. Locate accessories in order that they do not interfere with door swings or use of fixtures. Install accessories after wall finishes have been completed.
- D. Anchor accessories with bolts, plates, and approved type fasteners.
- E. Install surface mounted accessories to backup material with toggle bolts, plumb and align.
- F. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- G. Secure mirrors to walls in concealed, tamper-resistant manner with special hangers, toggle bolts, or screws. Set units level, plumb, and square at locations indicated, according to manufacturer's written instructions for substrate indicated.
- H. Install grab bars to withstand a downward load of at least 250 lbf (1112 N), when tested according to method in ASTM F 446.
  - 1. Anchor grab bars to drywall with concealed 16 gage steel anchor plates, or 4x wood blocking with A-35 clips to new or existing framing.
- I. Seal fastener holes with sanitary silicone sealant prior to mounting accessories and grab bars in showers. Set entire plate and perimeter trim in sealant to ensure watertight installation at penetrations to partitions.
- J. Adjust accessories for proper operation and smooth mechanical function.
- K. Clean and polish exposed surfaces after removal of protective coverings.

**3.4 SCHEDULE**

<u>ITEM</u>	<u>DESCRIPTION</u>	<u>MODEL NO.</u>
	COAT HOOK WITH BUMPER	B-212
	SURFACE-MOUNTED UTILITY HOOK	B-670
	GRAB BAR 1-1/4-INCH STAINLESS STEEL W/ CONCEALED FASTENERS (LENGTHS AS INDICATED ON DRAWINGS)	B-5806
	CLASSIC SERIES PARTITION-MOUNTED SEAT COVER DISPENSER, SANITARY NAPKIN DISPOSAL, AND TOILET TISSUE DISPENSER	B-357
	CLASSIC SERIES PARTITION-MOUNTED SEAT COVER DISPENSER, SANITARY NAPKIN DISPOSAL, AND TOILET TISSUE DISPENSER	B-3571
	RECESSED TOILET SEAT COVER DISPENSER, SANITARY NAPKIN DISPOSAL AND TOILET TISSUE DISPENSER	B-3574
	SURFACE-MOUNTED SOAP DISPENSER FOR LIQUID & LOTION SOAPS & DETERGENTS	AS-0343 B-2111 FB-1920
	LAVATORY MOUNTED SOAP DISPENSER	AS-0332
	MIRROR WITH STAINLESS STEEL CHANNEL FRAME AND SHELF	B-166 1836
	MIRROR WITH STAINLESS STEEL CHANNEL FRAME	B-165 2460
	RECESSED CONVERTIBLE PAPER TOWEL DISPENSER AND WASTE RECEPTACLE	B-3944
	TRIMLINE SERIES RECESSED NAPKIN / TAMPON VENDORS	B-3500 x 25
	SURFACE-MOUNTED STAINLESS STEEL SHELF	B-683
	SURFACE-MOUNTED BABY CHANGING STATION	B-2210
	GRAB BAR AT TOILET	HE-988-65-599-77 (801.35.IS.99 per drawings) WI-PUTWabWH
	HAND DRYER	DYSON AIRBLADE
	STRAIGHT SHOWER CURTAIN ROD	B-207
	VINYL SHOWER CURTAIN & STAINLESS STEEL SHOWER CURTAIN HOOK	B-204
	FOLDING SHOWER SEAT	Bradley Model 9567 & 9568

**- END OF SECTION -**



**- SECTION 10 2840 -****BUILDING SPECIALTIES**

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**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. This Section includes the following:
  - 1. Pencil sharpeners.
  - 2. Coat Hooks.

**1.3 SUBMITTALS**

- A. General: Submit in accordance with Section 01 3219.
- B. Product Data: Submit manufacturer's catalog cut sheets, and data sheets.
- C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required. Use designations indicated on Drawings.
- D. Submit following Informational Submittals:
  - 1. Certifications specified in Quality Assurance article.
  - 2. Manufacturer's instructions.
- E. Closeout Submittals:
  - 1. Submit under provisions of Section 01 7700.
  - 2. Maintenance data.

**1.4 QUALITY ASSURANCE**

- A. Regulatory Requirements: Conform to ANSI A117.1 or local code if more stringent requirements are applicable for installing work for accessibility to handicapped.

**1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Pack accessories individually with protective wrappings.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Manufacturers, Pencil Sharpeners:
  - 1. Boston/X-Acto. Product: KS Series Manual Pencil Sharpener. District Standard, No Substitutions Allowed.
- B. Manufacturers, Coat Hooks:
  - 1. Ives. Product: 571 Coat & Hat Hook. District Standard, No Substitutions Allowed.

### **2.2 MATERIALS**

- A. Pencil Sharpeners: All steel construction, X-ACTO hardened steel cutters; adjustable 8 hole pencil guide; wall mounted.
- B. Coat and Hat Hook:
  - 1. Description: Double-prong unit.
  - 2. Material and Finish: ANSI/BHMA A156.13 L33113 Cast Aluminum, polished.
  - 3. Dimensions: 1-3/4 inch H x 1-1/4 inch W. Projection 3 inches.
  - 4. Unit shall be equipped with two countersunk mounting screw holes for attachment to wall.
- C. Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel complying with ASTM A123 where concealed; theft-proof design at exposed conditions.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine conditions and proceed with Work when substrates are ready.
- B. Verify that site conditions are ready to receive work and dimensions are as indicated on shop drawings and instructed by manufacturer.
- C. Beginning of installation means acceptance of existing conditions.

### **3.2 PREPARATION**

- A. Verify exact location of accessories for installation.
- B. Protect adjacent or adjoining finished surfaces and work from damage during installation.
- C. Do not install accessories until room finishes are completed.

### 3.3 INSTALLATION

- A. Install in accordance Section 01400 and approved shop drawings.
- B. Install plumb, level, and securely anchored to substrate.
- C. Pencil Sharpeners:
  - 1. Mounting height shall be compliant with ADA requirements.
  - 2. Right-handed mounting.
- D. Coat Hooks:
  - 1. Coat hooks shall be installed at 66 inches AFF, centered on the office side of the door.
  - 2. At DSPS offices, a second lover hook shall also be installed at 48 inches AFF.
- E. Anchor accessories with bolts, plates, and approved type fasteners.
- F. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- G. Adjust accessories for proper operation and smooth mechanical function.
- H. Clean and polish exposed surfaces after removal of protective coverings.

**- END OF SECTION -**





## **- SECTION 10 4413 -**

# **FIRE EXTINGUISHER CABINETS**

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## **PART 1 - GENERAL**

### **1.1 RELATED DOCUMENTS**

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

### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Fire protection cabinets for the following:
    - a. Portable fire extinguishers.

### **1.3 RELATED SECTIONS**

- A. Section 10 1400 "Signage" for directional signage to out-of-sight fire extinguishers and cabinets.
- B. Section 10 4416 "Fire Extinguishers" for fire extinguishers and mounting brackets.

### **1.4 SUBMITTALS**

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire protection cabinets.
  - 1. Fire Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.
- B. Shop Drawings: For fire protection cabinets. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
  - 1. Size: 6 by 6 inches (150 by 150 mm) square.
- D. Product Schedule: For fire protection cabinets. Coordinate final fire protection cabinet schedule with fire extinguisher schedule to ensure proper fit and function. Use same designations indicated on Drawings.
- E. Maintenance Data: For fire protection cabinets to include in maintenance manuals.

## 1.5 QUALITY ASSURANCE

- A. Fire-Rated, Fire Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Preinstallation Conference: Conduct conference at Project site.
  - 1. Review methods and procedures related to fire protection cabinets including, but not limited to, the following:
    - a. Schedules and coordination requirements.

## 1.6 COORDINATION

- A. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate sizes and locations of fire protection cabinets with wall depths.

## 1.7 SEQUENCING

- A. Apply decals on field-painted, fire protection cabinets after painting is complete.

# PART 2 - PRODUCTS

## 2.1 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
- B. Aluminum: Alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated, and as follows:
  - 1. Sheet: ASTM B 209 (ASTM B 209M).
  - 2. Extruded Shapes: ASTM B 221 (ASTM B 221M).
- C. Stainless-Steel Sheet: ASTM A 666, Type 304.
- D. Transparent Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), 6 mm thick, with Finish 1 (smooth or polished).

## 2.2 FIRE PROTECTION CABINET

- A. Cabinet Type: Semi-Recessed suitable for fire extinguisher.
  - 1. Basis of Design: Gemini Series, Model FS-SS-G 2409-R4 as manufactured by Larsen's Manufacturing Company
  - 2. Subject to compliance with requirements, provide the named product or a comparable product by one of the following manufactures:

## FIRE EXTINGUISHER CABINETS

- a. Potter Roemer LLC.
  - b. J. L. Industries, Inc., a division of Activar Construction Products Group.
  - c. Kidde Residential and Commercial Division, Subsidiary of Kidde plc.
  - d. Larsen's Manufacturing Company.
  - e. Modern Metal Products, Division of Technico Inc.
- B. Cabinet Construction:
1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.0428-inch- (1.1-mm-) thick, cold-rolled steel sheet lined with minimum 5/8-inch- (16-mm-) thick, fire-barrier material. Provide factory-drilled mounting holes.
    - a. Provide fire-rated assemblies (1-hour and 2-hour) as required to meet rating of adjacent wall assembly construction.
- C. Cabinet Material: Steel sheet.
1. Shelf: Same metal and finish as cabinet.
- D. Semirecessed Cabinet: Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semirecessed cabinet installation.
1. Rolled Edge: 3-1/2 inch backbend depth.
- E. Cabinet Trim Material: Same material and finish as door.
- F. Door Material: Stainless-steel sheet.
- G. Door Styles:
1. Flush opaque panel, frameless, with no exposed hinges, color red with white letter in Student Activity Center.
- H. Door Glazing: Acrylic sheet.
1. Acrylic Sheet Color: White with black lettering.
- I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
1. Provide projecting lever handle with cam-action latch.
  2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.
- J. Accessories:
1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
  2. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
  3. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated.

- a. Identify fire extinguisher in fire protection cabinet with the words "FIRE EXTINGUISHER."
  - 1) Location: Applied to cabinet glazing.
  - 2) Application Process: Pressure-sensitive vinyl letters.
  - 3) Lettering Color: Black.
  - 4) Orientation: Vertical.
- K. Finishes:
  1. Manufacturer's standard baked-enamel paint for the following:
    - a. Exterior of cabinet, door and trim except for those surfaces indicated to receive another finish.
    - b. Interior of cabinet.
  2. Steel: Baked enamel or powder coat.
  3. Stainless Steel: No. 4.

### 2.3 FABRICATION

- A. Fire Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
  1. Weld joints and grind smooth.
  2. Provide factory-drilled mounting holes.
  3. Prepare doors and frames to receive locks.
  4. Install door locks at factory.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
  1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum **1/2 inch (13 mm)** thick.
  2. Fabricate door frames of one-piece construction with edges flanged.
  3. Miter and weld perimeter door frames.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

### 2.4 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire protection cabinets after assembly.
- D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

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## FIRE EXTINGUISHER CABINETS

## 2.5 STEEL FINISHES

- A. Surface Preparation: Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning" or SSPC-SP 8, "Pickling". After cleaning, apply a conversion coating suited to the organic coating to be applied over it.
- B. Factory Prime Finish: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.
- C. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of **2 mils (0.05 mm)**.
  - 1. Color and Gloss: As selected by Architect from manufacturer's full range.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine roughing-in for hose valves and cabinets to verify actual locations of piping connections before cabinet installation.
- B. Examine walls and partitions for suitable framing depth and blocking where recessed cabinets will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Prepare recesses for recessed fire protection cabinets as required by type and size of cabinet and trim style.

### 3.3 INSTALLATION

- A. General: Install fire protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights below acceptable to authorities having jurisdiction.
  - 1. Fire Protection Cabinets: 54 inches (1372 mm) above finished floor to top of cabinet.
- B. Fire Protection Cabinets: Fasten cabinets to structure, square and plumb.
  - 1. Unless otherwise indicated, provide recessed fire protection cabinets. If wall thickness is not adequate for recessed cabinets, provide semirecessed fire protection cabinets.
  - 2. Provide inside latch and lock for break-glass panels.
  - 3. Fasten mounting brackets to inside surface of fire protection cabinets, square and plumb.
  - 4. Fire-Rated, Hose and Valve Cabinets:
    - a. Install cabinet with not more than 1/16-inch (1.6-mm) tolerance between pipe OD and knockout OD. Center pipe within knockout.
    - b. Seal through penetrations with firestopping sealant as specified in Division 7 Section "Penetration Firestopping."

- C. Identification: Apply decals at locations indicated.

**3.4 ADJUSTING AND CLEANING**

- A. Remove temporary protective coverings and strippable films, if any, as fire protection cabinets are installed unless otherwise indicated in manufacturers written installation instructions.
- B. Adjust fire protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire protection cabinet and mounting bracket manufacturers.
- E. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

**- END OF SECTION -**

## - SECTION 10 4416 -

# FIRE EXTINGUISHERS

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### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

#### **1.3 RELATED SECTIONS**

- A. Section 10 4113 "Fire Extinguisher Cabinets" for cabinets.

#### **1.4 SUBMITTALS**

- A. Product Data: For each type of product indicated. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher
- B. Product Schedule: For fire extinguishers. Coordinate final fire extinguisher schedule with fire protection cabinet schedule to ensure proper fit and function.
- C. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.
- D. Warranty: Sample of special warranty.

#### **1.5 QUALITY ASSURANCE**

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.



## 1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Failure of hydrostatic test according to NFPA 10.
    - b. Faulty operation of valves or release levers.
  - 2. Warranty Period: Six years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire protection cabinet indicated.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Larsen's Manufacturing Company.
    - b. Amerex Corporation.
    - c. J. L. Industries, Inc.; a division of Activar Construction Products Group.
    - d. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
    - e.
  - 2. Valves: Stainless steel, or aluminum.
  - 3. Handles and Levers: Manufacturer's standard.
  - 4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.
- B. Multipurpose Dry-Chemical Type in Brass Container: UL-rated 4-A:80-B:C, **10-lb (4.5-kg)** nominal capacity, with monoammonium phosphate-based dry chemical in chrome-plated brass container.

### 2.2 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Amerex Corporation.
    - b. Ansul Incorporated; Tyco International Ltd.
    - c. Badger Fire Protection; a Kidde company.
    - d. Buckeye Fire Equipment Company.
    - e. Fire End & Croker Corporation.
    - f. J. L. Industries, Inc.; a division of Activar Construction Products Group.

## FIRE EXTINGUISHERS

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- g. Larsen's Manufacturing Company.
  - h. Potter Roemer LLC.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
- 1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
    - a. Orientation: Horizontal.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine fire extinguishers for proper charging and tagging.
  - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION**

- A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

**- END OF SECTION -**



## **- SECTION 10 5113 - METAL LOCKERS**

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### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. Section Includes:
  - 1. All-welded, metal lockers.
  - 2. Locker benches.

#### **1.3 RELATED SECTIONS**

- A. Section 01 81 13 "LEED Certification Requirements".
- B. Section 06 1053 "Miscellaneous Rough Carpentry" for concealed wood cleat in concrete base, furring, blocking, and shims required for installing metal lockers and concealed within other construction before metal locker installation.

#### **1.4 DEFINITIONS**

- A. Uncoated Steel Sheet Thicknesses: Indicated as the minimum thicknesses.

#### **1.5 SUBMITTALS**

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. LEED Submittal: See Section 018113 LEED Certification Requirements for the following:
  - 1. MRc4 Recycled Content: Product data for products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content.
    - a. Include cost information for each product having recycled content.

2. MRc5 Regional Materials:
  - a. Sourcing location(s): indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery from the project site.
  - b. Manufacturing location(s): indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
  - c. Product Value: indicate dollar value of product containing regional materials; include materials costs only.
  - d. Product Component(s) Value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.
- D. Show concrete base, sloping tops, filler panels, and other accessories.
- E. Include locker identification system.
- F. Samples for Initial Selection: For units with factory-applied color finishes.
- G. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.
- H. Warranty: Special warranty specified in this Section.

## 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative of metal locker manufacturer for installation and maintenance of units required for this Project.
- B. Source Limitations: Obtain metal lockers, locker benches and accessories through one source from a single manufacturer.
- C. Product Options: Drawings indicate size, profiles, and dimensional requirements of metal lockers and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
  1. Do not modify intended aesthetic effects, as judged solely by Owner's Representative, except with Owner's Representative's approval. If modifications are proposed, submit comprehensive explanatory data to Owner's Representative for review.
- D. Regulatory Requirements: Where metal lockers and benches are indicated to comply with accessibility requirements, comply with ICC/ANSI A117.1
  1. Provide not less than 1 shelf located no higher than 48 inches (1219 mm) above the floor for forward, and 54 inches (1372 mm) above the floor for side reach.
  2. Provide 1 shelf located at bottom of locker no lower than 15 inches (381 mm) above the floor for forward, and 9 inches (230 mm) above the floor for side reach.
  3. Provide latch that does not require tight grasping, pinching, or twisting of the wrist, and that operates with a force of not more than 5 lbf (22.2 N).
  4. Provide a minimum of 1-percent of lockers installed to be accessible per CBC 1115B.6.4., including latch, lock shelf, coat hook height, and ISA program.

## METAL LOCKERS

- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

### **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for metal locker installation.

### **1.8 PROJECT CONDITIONS**

- A. Field Measurements: Verify the following by field measurements before fabrication and indicate measurements on Shop Drawings:
  1. Concealed framing, blocking, and reinforcements that support metal lockers before they are enclosed.
  2. Recessed openings.
  3. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish recessed opening dimensions and proceed with fabricating metal lockers without field measurements. Coordinate wall and floor construction to ensure that actual recessed opening dimensions correspond to established dimensions.

### **1.9 COORDINATION**

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

### **1.10 WARRANTY**

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.
  1. Failures include, but are not limited to, the following:
    - a. Structural failures.
    - b. Faulty operation of latches and other door hardware.
  2. Damage from deliberate destruction and vandalism is excluded.
  3. Warranty Period for All-Welded Metal Lockers: 10 years from date of Substantial Completion.

### **1.11 EXTRA MATERIALS**

- A. Furnish extra materials described below, before construction begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  1. Full-size units of the following metal locker hardware items equal to 5-percent of amount installed for each type and finish installed, but no fewer than 4 units:
    - a. Locks.
    - b. Identification plates.

- c. Hooks.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.

### **2.2 MATERIALS**

- A. Cold-Rolled Steel Sheet: ASTM A 1008, Commercial Steel (CS) Type B, suitable for exposed applications.
- B. Expanded Metal: ASTM F 1267, Type II (flattened), Class I, 3/4-inch (19-mm) steel mesh, with at least 70 percent open area.
- C. Stainless-Steel Sheet: ASTM A 666, Type 304.
- D. Fasteners: Zinc- or nickel-plated steel, slotless-type exposed bolt heads, and self-locking nuts or lock washers for nuts on moving parts.
- E. Anchors: Select material, type, size, and finish required for secure anchorage to each substrate.
- F. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance.
- G. Provide toothed-steel expansion sleeves for drilled-in-place anchors.

### **2.3 ALL-WELDED, METAL LOCKERS**

- A. Available Products:
  - 1. Art Metal Products, Div. of Fort Knox Storage Co.; Champ Corridor Lockers.
  - 2. DeBourgh Mfg. Co.; Sentry Corridor/Personnel Lockers.
  - 3. Lyon Workspace Products; All-Welded Lockers.
  - 4. Penco Products, Inc., Subsidiary of Vesper Corporation; All-Welded Lockers.
  - 5. Republic Storage Systems, All Welded Ventilated.
- B. Locker Arrangement: As indicated on Drawings.
- C. Body: Assembled by welding body components together. Fabricate from unperforated, cold-rolled steel sheet with minimum thicknesses as follows:
  - 1. Tops, Bottoms, and Sides: 0.0528 inch (1.35 mm) thick.
  - 2. Backs: 0.0428 inch (1.1 mm) thick.

## **METAL LOCKERS**

3. Shelves: 0.0528 inch (1.35 mm) thick, with double bend at front and single bend at sides and back.
- D. Frames: Channel formed; fabricated from minimum 0.0528-inch- (1.35-mm-) thick, cold-rolled steel sheet; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral door strike full height on vertical main frames.
  - E. Locker Base: Structural channels, formed from 0.0528-inch- (1.35-mm-) thick, cold-rolled steel sheet; welded to front and rear of side-panel frames.
  - F. Doors: One-piece; fabricated from 0.0677-inch- (1.7-mm-) thick, cold-rolled steel sheet; formed into channel shape with double bend at vertical edges, and with right-angle single bend at horizontal edges.
    1. Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners for doors more than 15 inches (381 mm) wide; welded to inner face of doors.
    2. Door Style: Louvered Vents: No fewer than two louver openings at top and bottom, or three louver openings at top or bottom, for triple-tier lockers.
    3. Hinges: Self-closing; welded to door and attached to door frame with welded or factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees.
    4. Continuous Hinges: Manufacturer's standard, steel continuous hinge.
  - G. Recessed Door Handle and Latch: Stainless-steel cup with integral door pull, recessed so locking device does not protrude beyond face of door; pry resistant.
  - H. Multipoint Latching: Finger-lift latch control designed for use with built-in combination locks or padlocks; positive automatic and prelocking.
    1. Latch Hooks: Equip doors 48 inches (1219 mm) and higher with 3 latch hooks and doors less than 48 inches (1219 mm) high with 2 latch hooks; fabricated from minimum 0.1116-inch- (2.8-mm-) thick steel; welded to full-height door strikes; with resilient silencer on each latch hook.
    2. Latching Mechanism: Manufacturer's standard rattle-free latching mechanism and moving components isolated to prevent metal-to-metal contact and incorporating a prelocking device that allows locker door to be locked while door is open and then closed without unlocking or damaging lock or latching mechanism.
  - I. Accessible Projecting Turn-Handle and Latch: Steel handle welded to manufacturer's standard, three-point, cremone-type latch mechanism that consists of steel rods or bars that engage main locker frame at top and bottom of door, and center latch that engages strike jamb; with steel padlock loop.
    1. Provide at all accessible lockers. Color of lever handle to match lockers
  - J. Equipment: Equip each metal locker with identification plate and the following, unless otherwise indicated:
    1. Single-Tier Units: Shelf, one double-prong ceiling hook, and two single-prong wall hooks.
    2. Double-Tier Units: One double-prong ceiling hook and two single-prong wall hooks.
    3. Triple-Tier Units: One double-prong ceiling hook.



- K. Accessories:
1. Legs: 6 inches (152 mm) high; formed by extending vertical frame members, or fabricated from 0.075-inch (1.90-mm) nominal-thickness steel sheet; welded to bottom of locker.
  2. Closed Front and End Bases: Fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet.
  3. Continuous Sloping Tops: Fabricated from minimum 0.0428-inch- (1.1-mm-) thick, cold-rolled steel sheet; approximately 20-degree pitch.
  4. Closures: Vertical end type.
  5. Filler Panels: Fabricated from 0.0428-inch- (1.1-mm-) thick, cold-rolled steel sheet.
- L. Finish: Baked enamel or powder coat.
1. Color(s): As selected by Owner's Representative from manufacturer's full range.

## 2.4 LOCKER BENCHES

- A. Provide bench units with overall assembly height as indicated on Drawings.
- B. Bench Tops: Manufacturer's standard one-piece units, laminated maple with rounded corners and edges.
1. Size: Minimum 9-1/2 inches wide by 1-1/4 inches thick (241 mm wide by 32 mm thick) except provide minimum 20-inch- (508-mm-) wide tops where accessible benches are indicated.
  2. Laminated clear hardwood with one coat of clear sealer on all surfaces and two coat of clear lacquer on top and sides.
- C. Bench Brackets: Manufacturer's standard supports, with predrilled fastener holes for attaching bench top and anchoring to vertical surface, complete with fasteners and anchors.
1. Color: Bone.
- D. Fixed Pedestals: Manufacturer's standard supports, with predrilled fastener holes for attaching bench top and anchoring to floor, complete with fasteners and anchors, and as follows:
1. Tubular Steel: 1-1/4-inch- (32-mm-) diameter steel tubing, with 0.1265-inch- (3.2-mm-) thick steel flanges welded at top and base; with baked-enamel finish; anchored with exposed fasteners.
    - a. Color: Black.

## 2.5 FABRICATION

- A. General: Fabricate metal lockers square, rigid, and without warp; with metal faces flat and free of dents or distortion. Make exposed metal edges free of sharp edges and burrs, and safe to touch.
1. Form body panels, doors, shelves, and accessories from one-piece steel sheet, unless otherwise indicated.
  2. Provide fasteners, filler plates, supports, clips, and closures as required for a complete installation.
- B. Unit Principle: Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments.

## METAL LOCKERS

- C. All-Welded Construction: Factory preassemble metal lockers by welding all joints, seams, and connections, with no bolts, nuts, screws, or rivets used in assembly of main locker groups. Factory weld main locker groups into one-piece structures. Grind exposed welds flush.
- D. Accessible Lockers: Fabricate as follows:
1. Locate bottom shelf no lower than 15 inches (381 mm) above the floor.
  2. Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inches (1219 mm) above the floor.
- E. Hooks: Manufacturer's standard ball-pointed type, aluminum or steel; zinc plated.
- F. Identification Plates: Manufacturer's standard etched, embossed, or stamped aluminum plates; with numbers and letters at least 1/2 inch (12 mm) high.
- G. Continuous Base: Formed into channel or zee profile for stiffness, and fabricated in lengths as long as practical to enclose base and base ends of metal lockers; finished to match lockers.
- H. Continuous Sloping Tops: Fabricated in lengths as long as practicable, without visible fasteners at splice locations; finished to match lockers.
1. Sloped top corner fillers, mitered.
- I. Recess Trim: Fabricated with minimum 3-inch (76-mm) face width and in lengths as long as practicable; finished to match lockers.
- J. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slip joint filler angle formed to receive filler panel.
- K. Boxed End Panels: Fabricated with 1-inch- (25-mm-) wide edge dimension, and designed for concealing fasteners and holes at exposed ends of nonrecessed metal lockers; finished to match lockers.
1. Provide one-piece panels for double-row (back-to-back) locker ends.
- L. Finished End Panels: Designed for concealing unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.
1. Provide one-piece panels for double-row (back-to-back) locker ends.
- M. Center Dividers: Full-depth, vertical partitions between bottom and shelf; finished to match lockers.

## 2.6 STEEL SHEET FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Factory finish steel surfaces and accessories except stainless-steel and chrome-plated surfaces.
- C. Surface Preparation: Clean surfaces of dirt, oil, grease, mill scale, rust, and other contaminants that could impair paint bond. Use manufacturer's standard methods.

- D. Baked-Enamel Finish: Immediately after cleaning, pretreating, and phosphatizing, apply manufacturer's standard primer and thermosetting baked-enamel corrosive resistant finish. Comply with paint manufacturer's written instructions for application, baking, and minimum dry film thickness.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine walls, floors, and support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION**

- A. General: Install level, plumb, and true; shim as required, using concealed shims.
  - 1. Modify existing units to remain to permit installation of new units. Replace trim and accessories to meet requirements of this section.
  - 2. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than **36 inches (910 mm)** o.c. Install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion, using concealed fasteners.
  - 3. Anchor single rows of metal lockers to walls near top and bottom of lockers, or as shown on drawings.
  - 4. Anchor back-to-back metal lockers to each other.
- B. All-Welded Metal Lockers: Connect groups of all-welded metal lockers together with standard fasteners, with no exposed fasteners on face frames.
- C. Equipment and Accessories: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.
  - 1. Attach hooks with at least two fasteners.
  - 2. Attach door locks on doors using security-type fasteners.
  - 3. Identification Plates: Identify metal lockers with identification numbers.
    - a. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.
    - b. Attach plates to upper shelf of each open-front metal locker, centered, with a least two aluminum rivets.
  - 4. Attach recess trim to recessed metal lockers with concealed clips.
  - 5. Attach filler panels with concealed fasteners. Locate fillers panels as needed.
  - 6. Attach sloping top units to metal lockers, with closures at exposed ends.
  - 7. Attach boxed end panels with concealed fasteners to conceal exposed ends of nonrecessed metal lockers.
- D. Fixed Locker Benches: Provide no fewer than two pedestals for each bench, uniformly spaced not more than **72 inches (1830 mm)** apart. Securely fasten tops of pedestals to undersides of bench tops, and anchor bases to floor.

## **METAL LOCKERS**

**3.3 ADJUSTING, CLEANING, AND PROTECTION**

- A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding.
- B. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit metal locker use during construction.
- C. Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by metal locker manufacturer.

**- END OF SECTION -**



- SECTION 10 5116

**PHENOLIC LOCKERS**

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**PART 1 – GENERAL**

1.01 WORK INCLUDED

- A. Phenolic Lockers.
- B. Locker Hardware and Accessories.

1.02 RELATED DOCUMENTS

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

1.03 REFERENCES

- A. American Society for Testing and Materials:
  - 1. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Material
  - 2. ASTM D6578 Standard Practice for Determination of Graffiti Resistance
  - 3. ASTM D1037 Direct Screw Withdrawal Test
  - 4. ASTM D570 Standard Test Method for Water Absorption
  - 5. ASTM A167, 18-8, Type 304 Cast Stainless Steel
- B. *National Fire Protection Association (NFPA).*
- C. *UBC – Requirements for Handicapped.*
- D. *ADA, Accessibility Guidelines for Buildings and Facilities.*
- E. Southern Building Code.
- F. 2005 LD-3 NEMA Standard Test, Chemical Resistance, Modulus of Elasticity, Shear Strength and Compression Strength.

1.04 QUALITY STANDARDS

- A. Flame Spread: When tested in accordance with ASTM E84, Lockers, Athletic Lockers, Wardrobe Cabinets, School Cubbies and Locker Bench materials shall meet or exceed all requirements for Class B Flame Spread

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**PHENOLIC LOCKERS**

Rating and Smoke Developed and shall carry a Class B Fire Rating Certification in accordance with the requirements of NFPA and ICC. Class B Fire Rating Certification shall be in the name of the Locker Manufacturer and shall be less than six (6) months old.

1. Flame Spread shall not exceed 75.
  2. Smoke Developed shall not exceed 450.
- B. Locker Doors: Locker Door shall be the full width of the Locker Body and shall be frameless, allowing access to the entire width of the Locker. Framed Doors are unacceptable. Perimeter ventilation shall provide superior ventilation properties to traditional framed doors.
- C. Locker Body: Locker Body shall incorporate the Uni-Box® Locker Construction to allow for multiple Locker configurations within the same Locker Body. The Locker Body shall be white in color. The Uni-Box® shall incorporate mortise and tenon construction and shall be mechanically fastened with Stainless Steel fasteners. Shelves shall be mortised into side walls of the Uni-Box® and shall be secured with Stainless Steel fasteners.
- D. Graffiti Resistance Requirements: When tested in accordance with ASTM D6578, Locker materials shall prove resistant to all chemicals tested for a period of 1 to 10 minutes and shall leave no mar or blemish on the surface when cleaned. Locker materials shall have guaranteed surface clean ability from permanent markers and shall have Non-Ghosting properties.
- E. Scratch Resistance Requirements: When tested in accordance with ASTM D2197, Locker materials shall prove to be scratch resistant when the maximum Load Value exceeds 10 kilograms.
- F. Impact Resistance Requirements: When tested in accordance with ASTM D2794, Locker materials shall withstand an Impact Force Value in excess of 45 inch-lbs.
- G. Screw Holding Strength: When tested in accordance with ASTM D1037, Direct Screw Withdrawal Test, Locker materials shall withstand a direct pull force that exceeds 2,500 lbs per fastener.
- H. Tensile Strength: Locker materials shall have a Modulus of Elasticity of 1.55 Million PSI.
- I. Shear Strength: Locker materials shall have a Shear Strength of 2,000 PSI minimum.
- J. Compression Strength: Locker materials shall have a Compression Strength of 24,000 PSI minimum.

- K. Water Absorption Requirements: When tested in accordance with ASTM D570 Locker materials shall have a Water Absorption Rate of less than 0.37%.
- L. LEED® Contribution Requirements: Locker materials shall contribute LEED® Certification credits for New Construction, Existing Buildings and Schools. MR 4.1, 4.2, 5.1 & 5.2, and EQ 4.

#### 1.05 SUBMITTALS

- A. Product Data: Submit manufacturer's detailed technical data for materials, fabrication, and installation, including catalog cuts of anchors, hardware, fasteners, and accessories in accordance with– Submittal Procedures.
- B. Shop Drawings: Furnish Shop Drawings in quantities requested for fabrication and installation of Solid Phenolic Lockers. Include plans, elevations, sections, numbering, colors, details, and anchorages/ attachments to other work.
- C. Samples for Initial Selection:
  - 1. Submit manufacturer's color chart with manufacturer's full range of Standard Colors.
  - 2. Submit certification that materials furnished comply with requirements specified.
- D. Submit two (2) 6" square Samples of each color and finish for color verification after selections have been made.
- E. Maintenance Instructions: Provide manufacturer's printed Instructions for Cleaning and Maintenance of installed Work.
- F. Manufacturer's Written Warranty: Provide manufacturer's Written Warranty as detailed herein.

#### 1.06 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions in areas of installation by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
  - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating units without field measurements. Coordinate supports, adjacent construction, and wall openings to ensure actual dimensions correspond to Established Dimensions.

#### 1.07 DELIVERY, STORAGE AND HANDLING



- A. Deliver materials in manufacturer's original packaging to protect from damage.
- B. Store materials in manufacturer's original packaging in accordance with manufacturer's instructions. Store Lockers indoors, protected from the elements and construction hazards.
- C. Handle materials in a manner that will protect the finished product.

#### 1.08 MANUFACTURER'S WARRANTY

- A. Provide manufacturer's Twenty (10) year written limited warranty against breakage, corrosion, delamination and defects in workmanship of all Phenolic components; to be replaced without charge, excluding labor.

### PART 2 – PRODUCTS

#### 2.01 MANUFACTURERS

- A. Series Numbers and Model Descriptions for Solid Phenolic Lockers by Columbia Lockers®, a Division of PSiSC®, are listed below to provide a standard of quality. Other manufacturers may be submitted for evaluation by the architect. All submittals for approval shall be presented in accordance with the submittals clause of this document and must be presented at least ten (10) days prior to the bid date. All bids shall be based on the standard of quality established herein.
- B. Solid Phenolic Lockers, shall be Series 5821L, manufactured by COLUMBIA LOCKERS®, a Division of PSiSC®, P.O. Box 181, Columbia, S.C. 29202, 866-337-7286, Fax: 866-337-7291.

#### 2.02 MANUFACTURED LOCKER UNITS

- A. Phenolic Single Tier to Six Tier.

#### 2.03 MATERIALS

- A. Material shall be Solid Phenolic with a High Pressure Melamine matte finish surface made as an integral part of the core material. Laminated surfaces are not acceptable. Surface and edges shall be non-porous and shall not support fungus or bacteria. Provide material which has been selected for uniform color, surface flatness and smoothness. Exposed surfaces which exhibit discolorations, pitting, seam marks, roller marks, stains, telegraphing

of core material, or other imperfections on finished units are not acceptable. Defects such as chipping along edges and corners are unacceptable. Columbia Solid Phenolic shall meet or exceed all requirements for Class B Flame Spread Rating and Smoke Developed calculated according to ASTM E84, and shall carry a Class B Fire Rating Certification. Class B Fire Rating Certification shall be in the name of the Locker Manufacturer and shall be less than six (6) months old. Materials shall contribute to LEED® Certification credits. MR 4.1, 4.2, 5.1 & 5.2, and EQ 4.

- B. Material Thicknesses:
  1. Doors, Slope Tops, End Panels, and Toe Kick Plates – Minimum .50" (13 mm) Finished Thickness.
  2. Locker Uni-Box®, Tops, Bottoms, and Shelves – Minimum .375" (10 mm) Finished Thickness. Sides and Locker Backs – Minimum .3125" (8 mm) Finished Thickness.
- C. Colors: 7284 Figured Annigre, black hardware & hinges, black interior Manufacturer's Standard Colors.
- D. Locker Doors: Locker Door shall be the full width of the Locker Uni-Box® and shall be frameless, allowing access to the entire width of the Locker. Framed Doors are unacceptable. Perimeter ventilation shall provide superior ventilation properties to traditional framed doors. Doors shall be attached to the Hinge with Stainless Steel Theft Proof Torx Head with Pin fasteners.
- E. Locker Body: Locker Body shall incorporate the Uni-Box® Locker Construction to allow for multiple Locker configurations within the same Locker Body. The Locker Body shall be white in color. The Uni-Box® shall incorporate mortise and tenon construction and shall be mechanically fastened together with Stainless Steel fasteners. Locker Shelves shall be mortised into side walls of the Uni-Box® at location determined by Architect. Relocation of Shelves in the field shall be possible without the need for special tools or welders. The Hinge shall be attached to the Uni-Box® with Stainless Steel Theft Proof Torx Head with Pin Bolts. Lockers shall arrive at construction site fully assembled.
- G. Slope Tops, End Panels, and Toe Kick Plates: Shall be manufactured of the same color, thickness and material as the Locker Doors.

## 2.04 HARDWARE

- A. Hinges shall be made of 14 Gauge Type 304 Stainless Steel and shall have a Black Powder Coated finish. Hinge shall have five (5) knuckles and shall

be "Hospital" type with beveled top and bottom knuckles. Knuckles of Hinge shall be exposed to allow Door to open 180°.

- B. Locker Hasp Bar: Hasp shall be fabricated of 11 Gauge Type 304 Stainless Steel with a Satin Finish. All edges shall be polished and smooth. Hasp shall be attached to the Locker Body with two (2) Stainless Steel Theft Proof Torx Head with Pin, Through Bolts. Hasp shall extend through a slot in the face of the Locker Door and the Locker Number Plate. Locker Hasp Bar is to be used with padlocks (padlocks are not included).
- C. Coat Hooks: Coat Hooks shall be fabricated of 11 Gauge Type 304 Stainless Steel with a Satin Finish. All edges shall be polished and smooth. Coat Hooks shall be attached to the Locker Body with Stainless Steel Theft Proof Torx Head with Pin fasteners or Through Bolts. Provide three (3) Coat Hooks for Single Tier Lockers and three (3) for Double Tier and "Z" Lockers. Plastic and aluminum Coat Hooks are unacceptable.
- D. Number Plates: Provide a Number Plate for each Door or opening, in the sequence as indicated on the drawings. Number Plate shall be engraved from the back side to prevent the accumulation of dirt and grime.

## 2.05 FABRICATION

- A. General: Provide factory pre-assembled Locker units. Lockers shall be complete with all hardware and accessories listed above. Knock down units are unacceptable.
- B. Slope Tops and End Panels: Provide Slope Tops and End Panels as required to complete the installation of the Lockers.

## PART 3 – EXECUTION

### 3.01 SITE INSPECTION

- A. Verify that field dimensions are in accordance with Locker Shop Drawings. Inspect walls to insure that they are plumb and suitable for the installation of the Lockers.
- B. Check location of built up bases, built in framing or blocking, and wall openings to insure that they are in compliance with the approved Locker Shop Drawings.
- C. Have any inappropriate conditions corrected before beginning installation.

3.02 INSTALLATION

- A. Comply with manufacturer's written installation instructions. Install Lockers rigid, straight, plumb, and level.
- B. Through Bolt Locker Boxes together with Stainless Steel Theft Proof Torx Head with Pin, Through Bolts.
- C. Anchor Locker Boxes to the wall with provided anchor devices.
- D. Install Slope Tops, End Panels, Filler Strips and accessories in accordance with written instructions.

3.03 ADJUSTING AND CLEANING

- A. Hardware Adjustment: Adjust hardware according to manufacturer's written instructions for proper operation.
- B. Provide final protection and maintain conditions that ensure Lockers are without damage or deterioration at the time of substantial completion. Clean all exposed surfaces of Lockers and hardware.

**END OF SECTION**



## **DIVISION 11 – EQUIPMENT**

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## **- SECTION 11 5213 -**

# **PROJECTION SCREENS**

---

## **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:
  - 1. Front-projection screens, electrically operated, recessed ceiling mounted.
  - 2. Manually operated projection screens.

### **1.3 RELATED SECTIONS**

- A. Section 06 1053 "Miscellaneous Rough Carpentry" for miscellaneous wood blocking for screen mounting.
- B. Division 26 Sections for electrical service and connections including metal device boxes for switches and conduit, where required, for low-voltage control wiring.

### **1.4 SUBMITTALS**

- A. Product data for type of screen specified.
- B. Shop drawings showing details for installation of support structure and mounting details for screen.
  - 1. For manually operated projection screens:
    - a. Drop lengths.
    - b. Anchorage details.
    - c. Accessories.
  - 2. For electrically operated projection screens and controls:
    - a. Location of screen centerline relative to ends of screen case.
    - b. Location of wiring connections.
    - c. Drop length.
    - d. Connections to supporting structure for pendant- and recess-mounted screens.
    - e. Anchorage details, including connection to supporting structure for suspended units.



- f. Wiring Diagrams: For electrically operated units.
- C. Maintenance Data: For projection screens to include in maintenance manuals.

## 1.5 QUALITY ASSURANCE

- A. Single Source Responsibility: Obtain each type of projection screen from a single manufacturer as a complete unit, including necessary mounting hardware and accessories.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Coordination of Work: Coordinate layout and installation of projection screen with other construction supported by, or penetrating through, ceilings, including light fixtures, HVAC equipment, fire-suppression system, and partitions.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver projection screen until building is enclosed, other construction within space where screen will be installed is substantially complete, and installation of screen is ready to take place.
- B. Protect screen from damage during delivery, handling, storage, and installation.

# PART 2 - PRODUCTS

## 2.1 PROJECTION SCREEN SURFACES, GENERAL

- A. Material and Viewing Surface of Front Projection Screen: Obtain screen manufactured from mildew- and flame-resistant fabric of type indicated for specified screen and complying with the following requirements:
  - 1. Matte-White Viewing Surface: Peak gain of 0.9 to 1.0, and gain of not less than 0.8 at an angle of 50 degrees from the axis of the screen surface, with minimum gain characteristics complying with FS GG-S-00172D(1) for "Classroom/Lab" screen surface.
    - a. Application: Provide matte white surface with black masking borders unless otherwise indicated.
  - 2. Seamless Construction: Provide screen in sizes indicated without seams.
  - 3. Mildew Resistance: Provide mildew-resistant screen fabric as determined by Federal Standard 191A/5760. Rating of 0 or 1 when tested according to ASTM G 21.
  - 4. Provide up to 3 ft. extra drop (black color fabric) to bring bottom of screen to 42 inches above finished floor.
  - 5. Fire Performance Characteristics: Provide projection screen fabric identical to those materials that have undergone testing and passed requirements for flame resistance as indicated below:
    - a. NFPA 701 per small-scale test.
    - b. Flame Spread Index: Not greater than 75 when tested according to ASTM E 84.

## 2.2 MANUALLY OPERATED PROJECTION SCREENS

- A. General: Manufacturer's standard spring-roller-operated units, consisting of case, screen, mounting accessories, and other components necessary for a complete installation.
1. Screen Mounting: Top edge securely anchored to a 3-inch- (75-mm-) diameter, rigid steel roller; bottom edge formed into a pocket holding a tubular metal slat, with ends of slat protected by plastic caps, and with a saddle and pull attached to slat by screws.
- B. Surface-Mounted, Metal-Encased, Manually Operated Screens: Units designed and fabricated for surface mounting on wall or ceiling, fabricated from formed-steel sheet not less than **0.027 inch (0.7 mm)** thick or from aluminum extrusions; with flat back design and vinyl covering or baked-enamel finish. Provide units with matching end caps and concealed mounting.
1. Products: Subject to compliance with requirements, provide the following:
    - a. Da-Lite Screen Company. Models:
      - 1) Model C with Controlled Screen Return (CSR).
  2. Sizes of Viewing Surface:
    - a. Small Screen: 69 inches x 92 inches (1753 mm x 2337 mm). Part Number 79876
    - b. Large Screen: 87 inches x 116 inches (2210 mm x 2946 mm) Part Number 79878

## 2.3 ELECTRICAL OPERATED FRONT PROJECTION SCREENS

- A. General: Manufacturer's standard units consisting of case, screen, motor, controls, mounting accessories, and other components necessary for a complete installation. Provide units that are listed and labeled as an assembly by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
1. Low-Voltage Control: System consisting of a control unit with 24-V power supply, remote 3-button or 3-position switches, and interconnecting wiring. Switches are installed in recessed metal device boxes with flush cover plates matching other electrical device cover plates in room where switch is installed.
  2. Provide infrared remote control consisting of battery-powered transmitter and receiver for use with low-voltage control system.
  3. Motor in Roller: Instant-reversing motor of size and capacity recommended by screen manufacturer; with permanently lubricated ball bearings, automatic thermal-overload protection, preset limit switches to automatically stop screen in up and down positions, and positive-stop action to prevent coasting. Mount motor inside roller with vibration isolators to reduce noise transmission.
  4. Screen Mounting: Top edge securely anchored to rigid metal roller and bottom edge formed into a pocket holding a **3/8-inch- (9.5-mm-)** diameter metal rod with ends of rod protected by plastic caps.
    - a. Roller for motor in roller supported by vibration- and noise-absorbing supports.
- B. Recessed, Electrically Operated Screens with Automatic Ceiling Closure: Motor in roller or end-mounted motor units designed and fabricated for recessed installation in ceiling; with bottom of case composed of two panels fully enclosing screen, motor, and wiring, one panel hinged and designed to open and close automatically when screen is lowered and fully raised, the other removable or openable for access to interior of case.
1. Screen Case: Made from metal, wood products, and fire-retardant materials.
    - a. Provide screen case with trim flange to receive ceiling finish.

- b. Prime paint surfaces of screen case that will be exposed to view in the finished work.
    - c. Da-Lite Screen Co., Type 3, or equivalent.
  - 2. Screen: As indicated below, with top edge mounted on, and securely anchored to, a 6-inch-diameter rigid steel spring roller and bottom edge formed into a pocket holding a tubular metal slat with ends of slat protected by plastic caps and saddle and pull attached to slat by screws.
    - a. Material: Vinyl-coated glass fiber fabric.
    - b. Size of Viewing Surface: As indicated on Drawings.
- C. Available Products:
  - 1. Da-Lite Screen Co., Inc.; Cosmopolitan Electrol.
  - 2. Draper Inc.; Ambassador.
  - 3. Stewart Filmscreen Corporation; Model AB ElectriScreen.
- D. Provide metal or metal-lined motor enclosure on units with end-mounted motor.
- E. Provide metal or metal-lined wiring compartment on units with motor in roller.
- F. Tab Tensioning: Units have stainless-steel tensioning cables on both sides of screen connected to edges of screen by tabs to pull screen flat horizontally.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. General: Install projection screens at locations indicated in compliance with screen manufacturer's instructions.
- B. Install projection screen in position and relationship to adjoining construction as indicated, securely anchored to supporting substrate, and in manner that produces a screen with plumb and straight vertical edges and plumb and flat viewing surfaces.
- C. Install projection screen with screen case in position and relationship to adjoining construction as indicated, securely anchored to supporting substrate, and in manner that produces a smoothly operating screen with plumb and straight vertical edges and plumb and flat viewing surfaces when screen is lowered.
  - 1. Install low-voltage controls according to NFPA 70 and manufacturer's written instructions.
    - a. Wiring Method: Install wiring in raceway except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Use UL-listed plenum cable in environmental air spaces, including plenum ceilings. Conceal raceway and cables except in unfinished spaces.
  - 2. Test electrically operated units to verify that screen controls, limit switches, closure, and other operating components are in optimum functioning condition.
  - 3. Test manually operated unit to verify that screen operating components are in optimum functioning condition.

**3.2 INSTALLATION SCHEDULE**

- A. Electrical Operated Front Projection Screens
  - 1. Locations: Classrooms with 90 person occupancy.
- B. Manual Screens:
  - 1. Locations: Other locations as indicated.
  - 2. Size: As indicated on Drawings.

**3.3 PROTECTION AND CLEANING**

- A. Protect projection screen after installation from damage during construction. If despite such protection damage occurs, remove and replace damaged components or entire unit as required to provide unit in its original, undamaged condition.

**- END OF SECTION -**



## **- SECTION 11 5216 -**

# **PROJECTOR HANGER ASSEMBLY**

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## **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 ceiling mounted LCD projector hanger assembly, including
  1. Vertical pole.
  2. Security mounting hardware.
  3. Ceiling back plate.

### **1.3 RELATED SECTIONS**

- A. Section 09 5113 "Acoustical Panel Ceilings" for coordination of installation and specification on installation of support wires.
- B. Section 11 5213 "Projector Screens" for coordination of mounting height, and distance from face of screen.
- C. Division 26 Sections for electrical service and connections including metal device boxes for switches and conduit, where required, for low-voltage control wiring.

### **1.4 SUBMITTALS**

- A. General: Submit in accordance with Section 01 3219.
- B. Product Data: for type of mount specified.
- C. Shop drawings showing details for installation of support structure and mounting details for screen.
  1. Connections to supporting structure for face plate and pendant.
  2. Location of screen centerline relative to centerline and distance of projector mount.
  3. Location of wiring connections.
  4. Anchorage details.

## 1.5 QUALITY ASSURANCE

- A. Single Source Responsibility: Obtain each type of projection screen from a single manufacturer as a complete unit, including necessary mounting hardware and accessories.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Coordination of Work: Coordinate layout and installation of projection screen with other construction supported by, or penetrating through, ceilings, including light fixtures, HVAC equipment, fire-suppression system, and partitions.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver hanger assembly until building is enclosed, other construction within space where screen will be installed is substantially complete, and installation of screen is ready to take place.
- B. Protect unit from damage during delivery, handling, storage, and installation.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Chief Manufacturing, Inc. Savage, MN 55378 (800) 582-6480
  - 2. Peerless Industries, Inc. Melrose Park, IL 60160, tel: (800) 865-2112
  - 3. Video Mounting Products (VMP) Stevensville, MD 21666 (410) 643-6390

## 2.2 HANGER ASSEMBLY

- A. Back Plate shall contain an adjustable collar mount plate with a 1 1/2-11.5 NPS center threaded fitting and holes for outlet boxes (Raco 445 or Appleton 383 recommended) and antenna leads. It shall feature a tie wire support system to transfer the load to four attachment points (in the true ceiling above) with turnbuckles to fine tune the level of the ceiling tray. It shall be U.L. Listed.
  - 1. The finish shall be White Fused Epoxy.
- B. Lightweight Adjustable Suspended Ceiling Plate mounted above a 2' x 2' or 2' x 4' suspended grid ceiling tile with adjustability and projector mount placement anywhere within a standard ceiling grid furnished with the following:
  - 1. Extension column, including a short thread collar for flush mounts.
  - 2. Two electrical knockouts.
  - 3. Secure fasteners.

## PROJECTOR HANGER ASSEMBLY

4. Backplate Size:
  - a. Nominal Size: 25-inch by 8-inch, by 1/2-inch thick.
  - b. Load Capacity: 60 pounds.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine conditions and proceed with work when substrates are ready.

### **3.2 INSTALLATION**

- A. Hanger Assembly: Install in accordance with manufacturer's instructions.
- B. Install units plumb, level, square, and free from warp or twist while maintaining dimensional tolerances and alignment with surrounding construction.

### **3.3 ADJUSTING, CLEANING AND PROTECTION**

- A. Adjust parts for smooth, uniform operation.
- B. Clean as recommended by manufacturer. Do not use materials or methods which may damage finish or surrounding construction.
- C. Protect finished work.

**- END OF SECTION -**





## DIVISION 12 – FURNISHINGS

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## **- SECTION 12 2413 -**

# **ROLLER WINDOW SHADES**

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## **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. Sunscreen roller shades.
- B. Room darkening and sunscreen double roller shades.

### **1.3 RELATED SECTIONS**

- A. Section 09 2900 "Gypsum Board" for coordination with gypsum board assemblies for installation of shade pockets, closures and related accessories.
- B. Section 09 5113 "Acoustical Ceilings" for coordination with acoustical ceiling systems for installation of shade pockets, closures and related accessories.
- C. Division 16 - Electrical: Electric service for motor controls.

### **1.4 REFERENCES**

- A. ASTM G 21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
- B. NFPA 70 - National Electrical Code.
- C. NFPA 701 - Fire Tests for Flame-Resistant Textiles and Films.

### **1.5 SUBMITTALS**

- A. Submit under provisions of Section 01 3219 "Submittal Procedures".
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
  - 1. Preparation instructions and recommendations.
  - 2. Styles, material descriptions, dimensions of individual components, profiles, features, finishes and operating instructions.

3. Storage and handling requirements and recommendations.
  4. Mounting details and installation methods.
  5. Typical wiring diagrams including integration of motor controllers with building management system, audiovisual and lighting control systems as applicable..
- C. Shop Drawings: Plans, elevations, sections, product details, installation details, operational clearances, wiring diagrams and relationship to adjacent work.
1. Prepare shop drawings on Autocad or Microstation format using base sheets provided electronically by the Architect.
- D. Window Treatment Schedule: For all roller shades. Use same room designations as indicated on the Drawings and include opening sizes and key to typical mounting details.
- E. Selection Samples: For each finish product specified, one set of shade cloth options and aluminum finish color samples representing manufacturer's full range of available colors and patterns.
- F. Verification Samples: For each finish product specified, one complete set of shade components, unassembled, demonstrating compliance with specified requirements. Shadecloth sample and aluminum finish sample as selected. Mark face of material to indicate interior faces.
- G. Maintenance Data: Methods for maintaining roller shades, precautions regarding cleaning materials and methods, instructions for operating hardware and controls.

## 1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Obtain roller shades through one source from a single manufacturer with a minimum of twenty years experience in manufacturing products comparable to those specified in this section.
- B. Installer Qualifications: Installer trained and certified by the manufacturer with a minimum of ten years experience in installing products comparable to those specified in this section.
- C. Fire-Test-Response Characteristics: Passes NFPA 701 small and large-scale vertical burn. Materials tested shall be identical to products proposed for use.
- D. Electrical Components: NFPA Article 100 listed and labeled by either UL or ETL or other testing agency acceptable to authorities having jurisdiction, marked for intended use, and tested as a system. Individual testing of components will not be acceptable in lieu of system testing.
- E. Anti-Microbial Characteristics: 'No Growth' per ASTM G 21 results for fungi ATCC9642, ATCC 9644, ATCC9645.
- F. Mock-Up: Provide a mock-up (manual shades only) of one roller shade assembly for evaluation of mounting, appearance and accessories.
1. Locate mock-up in window designated by Architect.
  2. Do not proceed with remaining work until, mock-up is accepted by Architect.

**1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver shades in factory-labeled packages, marked with manufacturer and product name, fire-test-response characteristics, and location of installation using same room designations indicated on Drawings and in the Window Treatment Schedule.

**1.8 PROJECT CONDITIONS**

- A. Environmental Limitations: Install roller shades after finish work including painting is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

**1.9 WARRANTY**

- A. Roller Shade Hardware and Chain Warranty: Manufacturer's standard non-depreciating twenty-five year limited warranty.
- B. Standard Shadecloth: Manufacturer's standard twenty-five year warranty.
- C. Roller Shade Motors and Motor Control Systems: Manufacturer's standard non-depreciating five year warranty.
- D. Roller Shade Installation: One year from date of Substantial Completion, not including scaffolding, lifts or other means to reach inaccessible areas.

**PART 2 - PRODUCTS****2.1 MANUFACTURERS**

- A. Manufacturer: Basis of Design: MechoShade Systems, Inc., which is located at: 42-03 35th St.; Long Island City, NY 11101; Tel: 718-729-2020; Fax: 718-729-2941; So. Cal: Carlos Herrera, Tel: 626-369-7777 Fax: 626-369-1015 Email: [carlosh@mechoshade.com](mailto:carlosh@mechoshade.com); Web: [www.mechoshade.com](http://www.mechoshade.com)

**2.2 ROLLER SHADE TYPES**

- A. Manually Operated Shades:
  1. Mounting: Surface mounted.
  2. Configuration: Single solar shadecloth.
  3. Visually Transparent Single-Fabric Shadecloth:
    - a. Fabric: EuroTwill 6000 Series, extra dense twill-weave pattern at 2-3 percent open.
    - b. Color: 1004 Black/Brown.
  4. Visually Transparent Single-Fabric Shadecloth:
    - a. Fabric: Dense Linear Weave "1000 series", 3 percent open, dense linear weave.
    - b. Color: 1004 Black/Brown.

5. Vinyl Room Darkening Single-Fabric Shadecloth:
  - a. Fabric: "700 series", blackout material, washable and colorfast laminated and embossed vinyl coated fabric.
  - b. Color: 0706 Oyster.

B. Motorized Shades:

1. Mounting: Surface mounted. ( under light shelf)
2. Mounting: Recess mounted with ceiling pocket and fascia.
3. Mounting: Recess mounted without ceiling pocket or fascia.
4. Configuration: Single solar shadecloth.
5. Configuration: Double solar and blackout shadecloth. ( conference rooms)
6. Solar Shadecloths:
  - a. Fabric: EuroTwill 6000, extra dense twill-weave pattern at 2-3 percent open.
7. Blackout Shadecloths:
  - a. Fabric: "0700 series", blackout material, washable and colorfast laminated and embossed vinyl coated fabric.
8. Controls: Electrically operated, ICON intelligent low voltage control system.

**2.3 SHADE CLOTH**

- A. Visually Transparent Shadecloth: MechoShade Systems, Inc., EuroTwill series: 0.010 diameter (0.254 mm) non-raveling vinyl/polyester yarn, fabric thickness 0.025 inches (0.635 mm).
- B. Visually Transparent Shadecloth: MechoShade Systems, Inc., ThermoVeil group: 0.30 inch (0.762 mm) thick vinyl fabric, woven from 0.018 inch (0.457 mm) diameter extruded vinyl yarn comprising of 21 percent polyester and 79 percent reinforced vinyl.
- C. Vinyl Room Darkening Shadecloth: MechoShade Systems, Inc., 0700 series, 0.012 inches thick (0.30 mm) blackout material and weighing 0.81 lbs. per square yard, with a minimum of 62 threads per square inch.

**2.4 SHADE BAND**

- A. Shade Bands: Construction of shade band includes the fabric, the hem weight, hem-pocket, shade roller tube, and the attachment of the shade band to the roller tube. Sewn hems and open hem pockets are not acceptable.
  1. Hem Pockets and Hem Weights: Fabric hem pocket with RF-welded seams (including welded ends) and concealed hem weights. Hem weights shall be of appropriate size and weight for shade band. Hem weight shall be continuous inside a sealed hem pocket. Hem pocket construction and hem weights shall be similar, for all shades within one room.
  2. Shade Band and Shade Roller Attachment:
    - a. Use extruded aluminum shade roller tube of a diameter and wall thickness required to support shade fabric without excessive deflection. Roller tubes less than 1.55 inch (39.37 mm) in diameter for manual shades, and less than 2.55 inches (64.77 mm) for motorize shades are not acceptable.
    - b. Provide for positive mechanical engagement with drive / brake mechanism.

**ROLLER WINDOW SHADES**

- c. Provide for positive mechanical attachment of shade band to roller tube; shade band shall be made removable / replaceable with a "snap-on" snap-off" spline mounting, without having to remove shade roller from shade brackets.
- d. Mounting spline shall not require use of adhesives, adhesive tapes, staples, and/or rivets.
- e. Any method of attaching shade band to roller tube that requires the use of: adhesive, adhesive tapes, staples, and/or rivets are not acceptable.

## 2.5 SHADE FABRICATION

- A. Fabricate units to completely fill existing openings from head to sill and jamb-to-jamb, unless specifically indicated otherwise.
- B. Fabricate shadecloth to hang flat without buckling or distortion. Fabricate with heat-sealed trimmed edges to hang straight without curling or raveling. Fabricate unguided shadecloth to roll true and straight without shifting sideways more than 1/8 inch (3.18 mm) in either direction per 8 feet (2438 mm) of shade height due to warp distortion or weave design. Fabricate hem as follows:
  - 1. Standard concealed hem bar.
- C. Provide battens in standard shades as required assuring proper tracking and uniform rolling of the shadebands. Contractor shall be responsible for assuring the width-to-height (W:H) ratios shall not exceed manufacturer's standards or, in absence of such standards, shall be responsible for establishing appropriate standards to assure proper tracking and rolling of the shadecloth within specified standards. Battens shall be roll-formed stainless steel or tempered steel, as required.
- D. For railroaded shadebands, provide seams in railroaded multi-width shadebands as required to meet size requirements and in accordance with seam alignment as acceptable to Architect. Seams shall be properly located. Furnish battens in place of plain seams when the width, height, or weight of the shade exceeds manufacturer's standards. In absence of such standards, assure proper use of seams or battens as required to, and assure the proper tracking of the railroaded multi-width shadebands.
- E. Provide battens for railroaded shades when width-to-height (W:H) ratios meet or exceed manufacturer's standards. In absence of manufacturer's standards, be responsible for proper use and placement of battens to assure proper tracking and roll of shadebands.
- F. Blackout shadebands, when used in side channels, shall have horizontally mounted roll-formed stainless steel or tempered-steel battens not more than 3 feet (115 mm) on center extending fully into the side channels. Battens shall be concealed in a integrally-colored fabric to match the inside and outside colors of the shadeband, in accordance with manufacturer's published standards for spacing and requirements.
  - 1. Battens shall be roll formed of stainless steel or tempered steel and concave to match the contour of the roller tube.
  - 2. Batten pockets shall be self-colored fabric front and back RF welded into the shadecloth. A self-color opaque liner shall be provided front and back to eliminate any see through of the batten pocket that shall not exceed 1-1/2 inches (38.1 mm) high and be totally opaque. A see-through moire effect, which occurs with multiple layers of transparent fabrics, shall not be acceptable.



## 2.6 COMPONENTS

### A. Access and Material Requirements:

1. Provide shade hardware allowing for the removal of shade roller tube from brackets without removing hardware from opening and without requiring end or center supports to be removed.
2. Provide shade hardware that allows for removal and re-mounting of the shade bands without having to remove the shade tube, drive or operating support brackets.
3. Use only Delrin engineered plastics by DuPont for all plastic components of shade hardware. Styrene based plastics, and /or polyester, or reinforced polyester will not be acceptable.

### B. Motorized Shade Hardware and Shade Brackets:

1. Provide shade hardware constructed of minimum 1/8-inch (3.18 mm) thick plated steel, or heavier, thicker, as required to support 150 percent of the full weight of each shade.
2. Provide shade hardware system that allows for field adjustment of motor or replacement of any operable hardware component without requiring removal of brackets, regardless of mounting position (inside, or outside mount).
3. Provide shade hardware system that allows for operation of multiple shade bands offset by a maximum of 8-45 degrees from the motor axis between shade bands (4-22.5 degrees) on each side of the radial line, by a single shade motor (multi-banded shade, subject to manufacturer's design criteria).

### C. Manual Operated Chain Drive Hardware and Brackets:

1. Provide for universal, regular and offset drive capacity, allowing drive chain to fall at front, rear or non-offset for all shade drive end brackets. Universal offset shall be adjustable for future change.
2. Provide hardware capable for installation of a removable fascia, for both regular and/or reverse roll, which shall be installed without exposed fastening devices of any kind.
3. Provide shade hardware system that allows for removable regular and/or reverse roll fascias to be mounted continuously across two or more shade bands without requiring exposed fasteners of any kind.
4. Provide shade hardware system that allows for operation of multiple shade bands (multi-banded shades) by a single chain operator, subject to manufacturer's design criteria. Connectors shall be offset to assure alignment from the first to the last shade band.
5. Provide shade hardware system that allows multi-banded manually operated shades to be capable of smooth operation when the axis is offset a maximum of 6 degrees on each side of the plane perpendicular to the radial line of the curve, for a 12 degrees total offset.
6. Provide positive mechanical engagement of drive mechanism to shade roller tube. Friction fit connectors for drive mechanism connection to shade roller tube are not acceptable
7. Provide shade hardware constructed of minimum 1/8-inch (3.18 mm) thick plated steel or heavier as required to support 150 percent of the full weight of each shade.
8. Drive Bracket / Brake Assembly:
  - a. MechoShade Drive Bracket model M5 shall be fully integrated with all MechoShade accessories, including, but not limited to: SnapLoc fascia, room darkening side / sill channels, center supports and connectors for multi-banded shades.

- b. M5 drive sprocket and brake assembly shall rotate and be supported on a welded 3/8 inch (9.525 mm) steel pin.
- c. The brake shall be an over-running clutch design which disengages to 90 percent during the raising and lowering of a shade. The brake shall withstand a pull force of 50 lbs. (22 kg) in the stopped position.
- d. The braking mechanism shall be applied to an oil-impregnated hub on to which the brake system is mounted. The oil impregnated hub design includes an articulated brake assembly, which assures a smooth, non-jerky operation in raising and lowering the shades. The assembly shall be permanently lubricated. Products that require externally applied lubrication and or not permanently lubricated are not acceptable.
- e. The entire M5 assembly shall be fully mounted on the steel support bracket, and fully independent of the shade tube assembly, which may be removed and reinstalled without effecting the roller shade limit adjustments.
- f. Drive Chain: #10 qualified stainless steel chain rated to 90 lb. (41 kg) minimum breaking strength. Nickel plate chain shall not be accepted.

## 2.7 SHADE MOTOR DRIVE SYSTEM

- A. Shade Motors:
  - 1. Tubular, asynchronous (non-synchronous) motors, with built-in reversible capacitor operating at 110v AC (60hz), single phase, temperature Class A, thermally protected, totally enclosed, maintenance free with line voltage power supply equipped with locking disconnect plug assembly furnished with each motor.
  - 2. Conceal motors inside shade roller tube.
  - 3. Maximum current draw for each shade motor of 2.3 amps.
  - 4. Use motors rated at the same nominal speed for all shades in the same room.
- B. Total hanging weight of shade band shall not exceed 80 percent of the rated lifting capacity of the shade motor and tube assembly.

## 2.8 ACCESSORIES

- A. Pocket Accessories: As indicated on the Drawings.
  - 1. Roller Shade Pocket: For recessed mounting in acoustical tile, or drywall ceilings as indicated on the Drawings.
  - 2. Provide either extruded aluminum and or formed steel shade pocket, sized to accommodate roller shades, with exposed extruded aluminum closure mount, tile support and removable closure panel to provide access to shades.
  - 3. Provide "Vented Pocket" such that there will be a minimum of four 1 inch (25.4 mm) diameter holes per foot allowing the solar gain to flow above the ceiling line.
- B. Fascia:
  - 1. Continuous removable extruded aluminum fascia that attaches to shade mounting brackets without the use of adhesives, magnetic strips, or exposed fasteners.
  - 2. Fascia shall be able to be installed across two or more shade bands in one piece.
  - 3. Fascia shall fully conceal brackets, shade roller and fabric on the tube.

4. Provide bracket / fascia end caps where mounting conditions expose outside of roller shade brackets.
5. Notching of Fascia for manual chain shall not be acceptable.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

### **3.2 PREPARATION**

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

### **3.3 INSTALLATION**

- A. Install roller shades level, plumb, square, and true according to manufacturer's written instructions, and located so shade band is not closer than 2 inches (50 mm) to interior face of glass. Allow proper clearances for window operation hardware.
- B. To control the responsibility for performance of motorized roller shade systems, assign the design, engineering, and installation of motorized roller shade systems, motors, controls, and low voltage electrical control wiring specified in this Section to a single manufacturer and their authorized installer/dealer. The Architect will not produce a set of electrical drawings for the installation of control wiring for the motors, or motor controllers of the motorized roller shades. Power wiring (line voltage), shall be provided by the general contractor, in accordance with the requirements provided by the manufacturer. Coordinate the following with the roller shade installer/dealer:
  1. Contractor shall provide power panels and circuits of sufficient size to accommodate roller shade manufacturer's requirements, as indicated on the mechanical and electrical drawings.
  2. Contractor shall coordinate with requirements of roller shade installer/dealer, before inaccessible areas are constructed.
  3. General Contractor shall run line voltage as dedicated home runs (of sufficient quantity, in sufficient capacity as required) terminating in junction boxes in locations designated by roller shade dealer.
  4. General Contractor shall provide and run all line voltage (from the terminating points) to the motor controllers, wire all roller shade motors to the motor controllers, and provide and run low voltage control wiring from motor controllers to switch/ control locations designated by the Architect. All above-ceiling and concealed wiring shall be plenum-rated, or installed in conduit, as required by the electrical code having jurisdiction.

## **ROLLER WINDOW SHADES**

- 5. General Contractor shall provide conduit with pull wire in all areas, which might not be accessible to roller shade contractor due to building design, equipment location or schedule.
- C. Shade Dealer/installer shall adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.
- D. Clean roller shade surfaces after installation, according to manufacturer's written instructions.
- E. Engage Installer to train Owner's maintenance personnel to adjust, operate and maintain roller shade systems.

**3.4 PROTECTION**

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion

**- END OF SECTION -**



**- SECTION 12 3200 -****MANUFACTURED WOOD CASEWORK**

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**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. Modular fabricated casework units, covered with high-pressure plastic laminate.
- B. Epoxy lab tops, countertops and sinks.

**1.3 RELATED SECTIONS**

- A. Section 01 74 19 "Materials Recycling & Waste Management".
- B. Section 01 81 13 "LEED Certification Requirements".
- C. Section 06 1053 "Miscellaneous Rough Carpentry": for provisions in wood framing to anchor and support casework.
- D. Section 06 4023 "Architectural Woodwork" for interior standing and running trim, custom millwork, plastic-laminate, laminate countertops, and shop finishing of interior woodwork.
- E. Division 22 - Mechanical: Plumbing components integrated into casework and countertops.
- F. Division 26 - Electrical: Electrical components integrated into casework.

**1.4 REFERENCES**

- A. American Hardboard Association: AHA A135.4 – Basic Hardboard.
- B. Builders Hardware Manufacturers Association (BHMA):
  - 1. BHMA A 156.9 – American National Standard for Cabinet Hardware.
  - 2. BHMA A 156.18 – American National Standard for Materials and Finishes.
- C. Woodwork Institute (WI): WI Manual of Millwork, 11<sup>th</sup> Edition, formerly Woodworking Institute of California, (WIC)

- D. National Electrical Manufacturers Association: NEMA LD 3 – High Pressure Decorative Laminates.
- E. U.S. Department of Commerce, Product Standards (PS):
  - 1. PS 1 – Construction and Industrial Plywood.
  - 2. PS 20 – American Softwood Lumber Standard.

## 1.5 DEFINITIONS

- A. MDF: Medium-density fiberboard.
- B. Exposed Portions of Cabinets: Surfaces visible when doors and drawers are closed, including bottoms of cabinets more than **48 inches (1220 mm)** above floor, and surfaces visible in open cabinets.
- C. Semiexposed Portions of Cabinets: Surfaces behind opaque doors, such as interiors of cabinets, shelves, dividers, interiors and sides of drawers, and interior faces of doors. Tops of cases **78 inches (1980 mm)** or more above floor are defined as semiexposed.
- D. Concealed Portions of Cabinets: Surfaces not usually visible after installation, including sleepers, web frames, dust panels, and ends and backs that are placed directly against walls or other cabinets.
- E. Hardwood Plywood: A panel product composed of layers or plies of veneer, or of veneers in combination with lumber core, hardboard core, MDF core, or particleboard core, joined with adhesive, and faced both front and back with hardwood veneers.

## 1.6 SUBMITTALS

- A. Product Data: Medium-density fiberboard, plywood, cabinet liner, adhesive and hot melt glue for bonding plastic laminate, casework hardware and fire-rated materials.
- B. LEED Submittals:
  - 1. Product Data for Credit MR 4.1 and MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
    - a. Include statement indicating costs for each product having recycled content.
  - 2. Product Data for Credit MR 5.1 and MR 5.2: Regional Materials: Materials that have been extracted, harvested, or recovered, as well as manufactured, within **500 miles (800 km)** of Project site.
  - 3. Product Data for Credit MR 6.0: Include printed statement of costs for each rapidly renewable material.
  - 4. Certificates for Credit MR 7: Chain-of-custody certificates certifying that wood used to produce cabinets and countertops comply with forest certification requirements. Include evidence that mill is certified for chain of custody by an FSC-accredited certification body.
    - a. Include statement indicating costs for each certified wood product.
  - 5. Product Data for Credit EQ 4.4: For adhesives and composite wood products, documentation indicating that product contains no urea formaldehyde.

- C. Shop Drawings: Comply with WI requirements for shop drawings preparation. First page of shop drawings shall bear the WI Certified Compliance Label.
- D. Samples: Plastic laminate. If colors are not indicated on the Drawings, submit plastic laminate samples consisting of one full chain for preliminary selection and 6 samples of each selected color, pattern and finish.
- E. Casework manufacturers requesting approval shall submit Substitution Request Form, listing any and all deviations to the specification. As a means for evaluation, Casework manufacturers and fabricators shall submit a full-scale base sample cabinet prior to producing shop drawings. The sample shall be constructed to meet this project's specifications. The mock-up may be impounded by the Owner's Representative and retained until completion of the casework installation. Casework manufacturers shall submit evidence that the casework manufacturer has adequate plant, equipment, and manpower to produce the quality of casework specified and deliver on schedule.
- F. Certificates of Compliance: Submit WI Certified Compliance Certificate certifying that all installed millwork products conform to the Drawings, Specifications and WI Manual of Millwork for the WI Grade specified.

## 1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
- B. Source Limitations: Obtain manufactured wood casework from single source from single manufacturer.
- C. Forest Certification: Fabricate cabinets and countertops with wood and wood-based products produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
- D. Industry Standards:
  - 1. Casework construction and installation shall meet or exceed minimum requirements of Woodwork Institute (WI) – Manual of Millwork, eleventh edition except as otherwise specified herein.
  - 2. Casework construction and installation details shall comply with standard WI details and applicable seismic criteria of California Building Code (CBC).
  - 3. Issue WI Certified Compliance Certificate after fabrication and prior to shipping casework to work site.
    - a. Each unit of casework shall bear the WI Certificate Compliance Label.
    - b. Each countertop shall the bear the WI Certificate Compliance Label.
- E. Millwork specified shall be manufactured in accordance with the standards established in the Manual of Millwork of the Woodwork Institute of California, current edition, in the grade or grades hereinafter specified or as shown on the drawings. If the manufacturer of millwork is not a WIC licensee, Contractor shall furnish to Architect, prior to installation, a Certificate of Reinspection by the WIC indicating that the millwork in question meets the requirements of the WIC grade specified. If the manufacturer of millwork is a WIC licensee, each unit of millwork shall bear the WIC Certified Compliance grade stamp indicating the grade specified, and by the completion of the job WIC Certified Compliance Certificates shall be provided indicating the



grade specified. The foregoing shall not be construed to limit the power and authority of Architect to reject millwork which does not, in Architect's opinion, meet with any one or more of the specifications of the contract.

- F. Regulatory Requirements:
  - 1. California Building Code (CBC) for flammability and smoke regulations.
  - 2. California Building Code (CBC).
- G. Fabricator's Qualifications: Fabricator shall be a company specializing in architectural casework fabrications, with minimum of ten years documented experience fabricating similar components.
- H. Quality Assurance – Fabricator: The fabricator shall be equipped for and experienced in doing work, including fabrication, finishing, and installing, equal to standards specified, and be able to provide evidence of such experience to the Architect's and District's satisfaction. Failure to meet these qualifications may be sufficient cause for rejection.
- I. Field Measurements: Field verify dimensions for shop-fabricated items before productions.
- J. Coordination: Coordinate rough in for items installed through or in millwork and trim. Locate rough-ins for proper alignment with edges, faces and reveals. Coordinate backing and framing provisions in wall to ensure adequate support of casework.
- K. Installers Qualifications: Installer shall be a company specializing in architectural casework installation, with minimum of eight years documented experience installing similar components.
- L. Mock-Ups: Construct mock-ups in accordance with directions of Project Manager. Provide mock-up of the following:
  - 1. Base cabinet with doors and interior shelf.
  - 2. Base cabinet with drawers.
  - 3. Upper cabinet with doors and interior shelving.
  - 4. Plastic Laminate Countertops.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver manufactured wood casework only after painting, utility roughing-in, and similar operations that could damage, soil, or deteriorate casework have been completed in installation areas. If casework must be stored in other than installation areas, store only in areas where environmental conditions meet requirements specified in "Project Conditions" Article.
- B. Keep finished surfaces covered with polyethylene film or other protective covering during handling and installation.

## 1.9 PROJECT CONDITONS

- A. Project Conditions: Do not install casework and trim until required temperature and relative humidity conditions have been stabilized and will be maintained in installation areas.
- B. Environmental Requirements: Condition interior casework and trim products to building environment. Maintain temperature and humidity at completed work in accordance with requirements for storage.

## MANUFACTURED WOOD CASEWORK

**1.10 SPECIAL WARRANTY**

- A. The casework manufacturer or fabricator shall guarantee casework materials and workmanship for five years from the date of Substantial Completion. Defects reported within the guarantee period will be corrected without charge. Accessories such as sinks, fittings, apparatus, countertops, etc., shall be guaranteed for one year from date of Substantial Completion.
1. Failures include, but are not limited to, the following:
    - a. Delamination of components or other failures of glue bond.
    - b. Warping of components.
    - c. Failure of operating hardware.
    - d. Deterioration of finishes.

**1.11 EXTRA MATERIALS**

- A. Furnish complete touchup kit for each type and finish of manufactured wood casework provided. Include scratch fillers, stains, finishes, and other materials necessary to perform permanent repairs to damaged casework finish.

**PART 2 - PRODUCTS****2.1 CONTRACTOR'S OPTION**

- A. General Contractor at his/her option may elect to furnish casework by institutional casework manufacture listed below in lieu of custom fabrication of all specified units, whereas the manufacture shall meet the minimum requirements of these project specifications.
1. Manufacturers and Fabricators are subject to qualification as noted within this section. Selected source must be able to provide WI certification of casework fabrication, and obtain approval by the Project Manager of full-size mock-up as specified in the Submittal section above.
  2. Contractor must provide all fabricated units through one source, excluding laminate countertops.
- B. Manufacturers: Subject to compliance with requirements, provide institutional casework manufactured by one of the following:
1. LSI Corporation of America (Series L-44).
  2. TMI Design Systems (Trimline 7000 Series).
  3. Westmark Products (Series 300).
  4. Stevens Case Master.

**2.2 MATERIALS, GENERAL**

- A. Low-Emitting Materials: Provide manufactured wood casework, including countertops, made with adhesives and composite wood products containing no urea formaldehyde.
- B. Softwood Lumber: Graded in accordance with WI Manual of Millwork, maximum moisture content of 6 percent, any species and grade as allowed for Grade specified for woodwork product, unless otherwise indicated.

- C. Hardwood Lumber: Graded in accordance with WI Manual of Millwork, for concealed locations in plastic laminate casework, alder, birch or maple.
- D. Plywood Base for Plastic Laminate: Close-grained hardwood plywood, ANSI/AHA 135.4, all hardwood plies, non-telegraphing faces, formaldehyde-free and complying with requirements for referenced WI grade.
  - 1. Provide minimum thickness according to WI quality standards, as detailed on drawings and as specified herein.
  - 2. Provide exterior grade product with waterproof glue (marine grade plywood) at countertop locations with plumbing fixtures.
- E. Agrifiber: Solid agrifiber composite core conforming to ANSI 208.1 LD-2 consisting of recycled agricultural fiber with no added urea-formaldehyde bonding resins.
- F. Wood Fiber Board: ANSI A208.2, Grade MD, medium density fiberboard (MDF), composed of wood chips matrix bound with formaldehyde-free, high-moisture resistant, polyurea resin binders, passing ASTM D1037 – Six Cycle Accelerated Aging Test. Provide minimum thickness according to WI Manual of Millwork and details indicated on the Drawings.
  - 1. Arreis MDF as manufactured by SierraPine, Roseville, CA, tel: (800) 676-3339.
- G. Particleboard: Not permitted.
- H. Hardboard: ANSI/AHA 135.4, interfelted lignocellulosic fibers consolidated under heat and pressure, tempered treated, smooth one side. Provide thickness indicated or, if not indicated, 1/8 inch thick when used as a laminate and 1/4 inch thick (minimum) when used as drawer bottom, cabinet back or dust panel.
- I. Thermoset Decorative Panels: Particleboard or MDF finished with thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.

### 2.3 PLASTIC LAMINATE MATERIALS

- A. Basis-of-Design Product: The District's Standard is based on Pionite: Pioneer Plastics Corp., Auburn, ME 207.784.9111 or 800.777.8113, NO SUBSTITUTIONS ALLOWED.
- B. Plastic Laminate: NEMA LD3 and ANSI A161.2
  - 1. Horizontal applications at countertops, not post-formed: NEMA Type GP 50 (0.050 cut nominal thickness).
  - 2. Horizontal application at countertops, post-formed: NEMA Type PF42 (0.0039-inch nominal thickness) horizontal post-forming grade.
  - 3. Horizontal applications, other than countertops, and mill option for vertical application NEMA Type PF42 (0.039-inch nominal thickness).
  - 4. Vertical applications: NEMA Type GP 28 (0.028-inch nominal thickness) or NEMA Type PF42 (0.039-inch nominal thickness).
  - 5. Colors and patterns: As indicated on Architectural Drawings. If not indicated, then as selected by Architect from manufacturer's full selection of matte finish solid colors.
- C. Plastic Laminate Backing: NEMA LD-3, BK 20, high pressure paper base laminate without a decorative finish; Style ND, Type IV< 0.020-inch thick, smooth surface finish, for backing of countertops and other concealed locations.

## MANUFACTURED WOOD CASEWORK

- D. Thermally-fused Saturated Melamine Component Panel (MCP): Provide thermoset decorative panels for semiexposed surfaces unless otherwise indicated.
1. Thermoset acid resistant melamine impregnated paper permanently bonded to particleboard substrate. Color: White, both faces.
  2. Applicable standards:
    - a. Federal standards.....FSL-P508H
    - b. ASTM.....FSL-P508H
    - c. USFDA.....D-1300-53T
    - d. ANSI/NEMA.....LD3-1991
- E. Edging: 3mm thick PVC. Solid, high impact, purified, color-thru, acid-resistant, PVC edging machine-applied with hot melt adhesives, automatically trimmed and inside/outside length-radiused for uniform appearance, buffed and corner-radiused for consistent design. Use for door/drawer edges.

## 2.4 ANCHORS, FASTENERS AND ACCESSORIES

- A. Anchor Type, Sizing and Spacing: Unless otherwise indicated, provide fasteners of type, grade and class required for intended use and sized and spaced as required for loads and substrate. Refer to special seismic anchoring requirements noted on Drawings.
- B. Anchors and fasteners: Select material, type, size, and finish required by each substrate for secure anchorage. Provide non-ferrous metal or hot-dip galvanized anchors and inner face of exterior walls and elsewhere as required for corrosion resistance.
1. Screws: For use at wood or metal stud walls, minimum #14 x 3", Phillips truss head, type 17 hard, zinc plated, self-tapping, full head screws. Select material, type size, and finish required for each use. Comply with applicable requirements of FS FF-S-11. For attachment to metal framing supports, provide screws as indicated on Drawings.
  2. Countertop segment anchors: Tite Joint Fasteners.
- C. Exposed Anchors and Fasteners: Same material, color and finish as the metal to which applied, except use only stainless steel at aluminum material and use cadmium plated at interior pre-painted steel products.
- D. Contract Adhesives: formaldehyde-free, Type II Water-Resistant typically and Type I Fully Waterproof at damp locations and countertops.
- E. Wall Adhesive: Solvent release, cartridge type, compatible with wall substrate, capable of achieving durable bond.
- F. Countertop Segment Adhesive: Rigid (urea, resorcinol) adhesive, complying with requirements for WI Type II Water-Resistant adhesive.

## 2.5 HARDWARE

- A. Refer to Section 06 4023 "Interior Architectural Woodwork" for cabinetry hardware to include, but not limited to the following:
1. Door hinges.
  2. Drawer slides.

3. Door and drawer pulls.
4. Drawer stops.
5. Shelf supports.
6. Cabinetry locks.
7. Grommets.

## 2.6 CASEWORK FABRICATION

- A. Casework Fabrication, General: Shop fabricate casework in compliance with WI Manual of Millwork for grade specified. Shop fabricate casework and countertops for delivery to site in units easily handled and to permit passage through building openings. See Drawings for special casework fabrication details and notes.

## 2.7 WOOD-FACED CASEWORK FABRICATION

- A. Wood-Faced Cabinet Construction: As required by referenced quality standard, but not less than the following:
1. Bottoms of Cabinets and Tops of Wall Cabinets: 3/4-inch (19-mm) hardwood plywood.
  2. Ends of Cabinets: 3/4-inch (19-mm) hardwood plywood.
  3. Shelves: 3/4-inch (19-mm) veneer-core hardwood plywood.
  4. Base Cabinet Top Frames: 3/4-by-2-inch (19-by-51-mm) solid wood with mortise and tenon or doweled connections, glued and pinned or screwed.
  5. Base Cabinet Stretchers: 3/4-by-4-1/2-inch (19-by-114-mm) plywood, particleboard, or MDF strips or solid-wood boards at front and back of cabinet, glued and pinned or screwed.
  6. Base Cabinet Subtops: 3/4-inch (19-mm) panel product glued and pinned or screwed.
  7. Backs of Cabinets: 3/4-inch (19-mm) particleboard-core hardwood plywood where exposed, 1/2-inch (12.7-mm) hardwood plywood dadoed into sides, bottoms, and tops where not exposed.
  8. Drawer Fronts: 3/4-inch (19-mm) particleboard-core hardwood plywood or solid hardwood.
  9. Drawer Sides and Backs: 1/2-inch (12.7-mm) solid-wood or hardwood plywood, with glued dovetail or multiple-dowel joints.
  10. Drawer Bottoms: 1/4-inch (6.4-mm) veneer-core hardwood plywood glued and dadoed into front, back, and sides of drawers. Use 1/2-inch (12.7-mm) material for drawers more than 24 inches (600 mm) wide.
  11. Doors 48 Inches (1220 mm) or Less in Height: 3/4 inch (19 mm) thick, with solid hardwood stiles and rails, particleboard or MDF cores, and hardwood face veneers and crossbands.
  12. Doors More Than 48 Inches (1220 mm) in Height: 1-1/16 inches (27 mm) thick, with solid hardwood stiles and rails, honeycomb cores, and hardwood face veneers and crossbands.
  13. Doors More Than 48 Inches (1220 mm) in Height: 1-1/8 inches (29 mm) thick, with particleboard cores and hardwood face veneers and crossbands.

**2.8 PLASTIC LAMINATE-COVERED CASEWORK FABRICATION**

- A. Plastic Laminate-Covered Casework Fabrication: Provide high-pressure plastic laminate covered casework complying with WI Manual of Millwork, Section 15 – Plastic-Covered Casework, as follows:
1. Grade: Custom.
  2. Construction Style: Style A, frameless.
  3. Construction Type: WI Type I, Self-supporting units capable of interchangeable use..
  4. Door and Drawer Front Style: WI Flush Overlay.
- B. Construction Details: Comply with referenced WI standard, with details and notes indicated on the Drawings, and the following:
1. Cabinet cases: 3/4-inch thick medium-density fiberboard core, with high-pressure plastic laminate at exposed faces and edges and high-pressure cabinet liner at semi-exposed faces.
  2. Doors: 3/4-inch thick medium-density fiberboard core, with high pressure plastic laminate at exposed faces and either high-pressure decorative plastic laminate or high pressure cabinet liner at semi-exposed faces.
  3. Drawer fronts: 3/4-inch thick medium-density fiberboard core with high-pressure decorative plastic laminate on exposed face and either high-pressure decorative plastic laminate with high-pressure cabinet liner on semi-exposed face.
  4. Drawer sides, backs and sub-fronts: 1/2-inch thick solid stock hardware lumber faced with high-pressure cabinet liner material on interior face and clear lacquer finish on the surfaces.
  5. Drawer bottoms: Hardware plywood, faced with high-pressure cabinet liner materials at upper face, ploughed into drawer sides, backs and sub-fronts.
    - a. Provide 1/4inch thick plywood at drawers less than 30-inches wide.
    - b. Provide 3/8-inch thick plywood at drawers 30-inches and wider.
    - c. Provide 3/4-inch thick hardwood plywood, routed to receive file followers at the drawers.
  6. Shelves: Medium-density fiberboard or plywood, as suitable for shelf size, faced concealed surfaces with high-pressure cabinet liner, exposed faces with laminate. Particleboard will not be acceptable material with WI Technical Bulletin 435 for core material options for 50-psf shelf loading.
  7. Adjustable Shelves: Supported on metal shelf rests in vertical rows of cleanly bored holes in cabinet sides, not exceeding 2-inches on center.
    - a. Locate rows between 1-1/2 and 2-inches from front and back of faces of cabinet backs.
    - b. Row size, spacing and location shall be identical throughout Project.
  8. Dust panels: 1/4 inch thick plywood or hardboard, above compartments and drawers except where located directly under tops, to vertically secure spaces at locked cabinets.
  9. Closures: Minimum 1-inch and maximum 3-inches wide, scribed to wall. Close all caps in face, bottom and top of cabinets. Provide closure at all cabinet sides abutting walls or ensure clearance for door to swing open fully.
  10. Lumber components: As follows except if otherwise indicted on the Drawings.
    - a. Backing cleats: 3/4 -inch by nominal 40-inches.
    - b. Web rails: 3/4-inch by nominal 4-inches.
    - c. Base and sleepers: 3/4-inch by net 4-inches.

11. Closures: Minimum 1-inch and maximum 3-inches wide, scribed to wall. Close all gaps on face, bottom and top of cabinets. Provide closure at all cabinet sides abutting walls, to ensure clearance for door to swing open fully.
- C. Laminate Cladding: Apply plastic laminate finish in full un-interrupted sheets consistent with manufactured sizes. Make corners and joints hairline. Slightly bevel edges.
- D. Field Cutting and fitting Provisions: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.
- E. Base or Full-Height Cabinets Fabrication:
  1. Mounting strips: Minimum ½ -inch by 2-1/2 inch, at top and bottom of case. Provide intermediate mounting strip at middle of casework 60-inches and taller, including book cases.
  2. Back: 3/8-inch thick particleboard, dadoed into top rail, sides and bottom of cabinet.
  3. Base cabinet depth: 23-1/8 inches, excluding door and drawer front thickness, unless otherwise indicated on the Drawings.
  4. Base cabinet height: 34 inches to top of countertop work surface, unless otherwise indicated on the Drawings.
  5. Full-height cabinet depth: As indicated on the drawings, excluding door and drawer front thicknesses.
  6. Full-height cabinet height: As indicated on the Drawings.
  7. Cabinet width: Align wall cabinet end panels with base cabinet end panels and not countertop edge.
  8. Toe Kicks: Separate from or integral with base unit casework, 4-inches high by 2-inches deep at front and 4-inches high by ¾-inch deep at exposed ends.
  9. Drawer construction: Dovetailed joints at drawer box, with drawer bottom ploughed into drawer sides, backs and sub fronts.
    - a. Hot-melt glue drawer bottom in place.
    - b. Glue all drawer box joints.
    - c. File drawers shall be fabricated to receive standard, letter-size Pendaflex hanging file folders; provide steel rails for hanging files.
  10. Door and drawer pulls:
    - a. Install door pulls horizontally, 1-1/2 inches down from top edge of door and with mounting hole centered 1-1/2 inches from strike (non-hinge) edge of door.
    - b. Install drawer pulls horizontally, centered horizontally on drawer faces and 1-1/2 inches down from top edge of drawer front, unless otherwise indicated on the Drawings. Do not install pulls on false drawer fronts or sink base panels. Do not install pulls on drawers located directly above knee spaces, such as pencil drawers, or on keyboard trays.
  11. Door catches at doors without locks: Install typically on all doors except as specified below for double doors with locks. Install spring-loaded latch body to inside face of door, with the catch installed on the bottom face of cabinet bottom panel. Center catches 1-1/2 inches from strike (non-hinge) edge of door.
  12. Door catches at double doors with locks: Installed on door leaf without lock. Install spring-loaded latch body to inside face of door, with the catch installed on top face of cabinet bottom panel. Center catches 1-1/2 inches from strike (non-hinge) edge of door.

13. Shelves:
  - a. Shelves, base cabinets: Unless otherwise indicated, one adjustable shelf.
  - b. Shelves, full-height cabinets: As indicated on the Drawings or, if not indicated a shelf for each 12-inches of clear open height in cabinet.

F. Wall Cabinets Fabrication:

1. Wall cabinet height: 3-inches, unless otherwise indicated on the Drawings, provide closure to ceiling or soffit, typically.
2. Mounting strips: Minimum 1/2 inches by 2-1/2 inch, at top and bottom of case. Provide intermediate mounting strip at middle of casework 60-inches and taller.
3. Back: 1/4 -inch thick tempered hardboard, dadoed into top rail, sides and bottom of cabinets.
4. Wall cabinet depth: 11-7/8-inches, excluding door and drawer front thicknesses.
5. Shelves: Unless otherwise indicated, all wall cabinets shall have two adjustable shelves.
6. Door pulls: Install door pulls horizontally, 1-1/2 inches down from top edge of door and with mounting hole centered 1-1/2 inches from strike (non-hinge) edge of door.
7. Door catches at doors without locks: Install typically on all doors except as specified below for double doors with locks. Install spring-loaded latch body to inside face of door, with the catch installed on the bottom face of cabinet bottom panel. Center catches 1-1/2 inches from strike (non-hinge) edge of door.
8. Door catches at double doors with locks: Installed on door leaf without lock. Install spring loaded latch body to inside face of door, with the catch installed on top face of cabinets bottom panel. Center catches 1-1/2 inches from strike (non-hinge) edge of door.

## 2.9 PLASTIC LAMINATE COUNTERTOPS FABRICATION

- A. Plastic Laminate Countertop Core Material:
  1. Countertops without sinks: Medium density fiberboard (MDF), 3/4-inch minimum thickness except 1-inch thickness for mobile units.
  2. Countertops with sinks, and wet areas: Marine grade plywood, 3/4 inch thick.
- B. Plastic Laminate Countertops Fabrication, General: WI Section 16 Premium Grade at locations with sides and at Reception Counters and WI Custom Grade at all other locations. See Drawings for details and notes for fabrication of Reception Counts.
  1. See Shop Drawings for locations.

## 2.10 EPOXY COUNTERTOP, TABLE TOP AND SINK MATERIALS

- A. Epoxy: Factory-molded, modified epoxy-resin formulation with smooth, nonspecular finish and contains no less than 10 percent post-consumer recycled content.
  1. Manufacturers: The Durcon Company.
    - a. Product: Greenstone Worksurface; Epoxyn Products.
  2. Physical Properties:
    - a. VOC's (ASTM E595): 0.011 percent by Weight.
    - b. Tensile Strength (ASTM D638): 6,400 psi.
    - c. Flexural Strength (ASTM D790): 13,600 psi.



- d. Compressive Strength (ASTM D695): 38,100 psi.
  - e. Hardness (Rockwell M) (ASTM D785): 113.
  - f. Water Absorption (24 Hours) (ASTM D570): 0.01 percent.
  - g. Nominal Weight: 11 lbs. per sq. ft.
  - h. Thickness: 1 inch.
3. Chemical Resistance: Epoxy-resin material has the following ratings when tested with indicated reagents according to NEMA LD 3, Test Procedure 3.4.5:
- a. No Effect: Acetic acid (98 percent), acetone, ammonium hydroxide (28 percent), benzene, carbon tetrachloride, dimethyl formamide, ethyl acetate, ethyl alcohol, ethyl ether, methyl alcohol, nitric acid (70 percent), phenol, sulfuric acid (60 percent), and toluene.
  - b. Slight Effect: Chromic acid (60 percent) and sodium hydroxide (50 percent).
4. Edge profile: As selected by Architect.
- B. Color: As selected by Architect.

## 2.11 COUNTERTOPS, TABLE TOPS AND SINKS FABRICATION

- A. Countertops, General: Provide units with smooth surfaces in uniform plane free of defects. Make exposed edges and corners straight and uniformly beveled. Provide front and end overhang of 1 inch (25 mm), with continuous drip groove on underside 1/2 inch (13 mm) from edge.
- B. Sinks, General: Provide sizes indicated or laboratory casework manufacturer's closest standard size of equal or greater volume, as approved by Architect.
- 1. Outlets: Provide with strainers and tailpieces, **NPS 1-1/2 (DN 40)**, unless otherwise indicated.
  - 2. Overflows: For each sink except cup sinks, provide overflow of standard beehive or open-top design with separate strainer. Height **2 inches (50 mm)** less than sink depth. Provide in same material as strainer.
- C. Epoxy Countertops, Table Tops and Sinks:
- 1. Countertop Fabrication: Fabricate with factory cutouts for sinks, holes for service fittings and accessories, and with butt joints assembled with epoxy adhesive and concealed metal splines.
    - a. Countertop Configuration: Raised (marine) edge, **1-inch (25-mm)** minimum thickness, with integral or applied raised edge having beveled or rounded edge and corners, and with integral coved or applied backsplash.
    - b. Countertop Construction: Uniform throughout full thickness.
  - 2. Sink Fabrication: Molded in 1 piece with smooth surfaces, coved corners, and bottom sloped to outlet; **1/2-inch (13-mm)** minimum thickness.
    - a. Provide with polypropylene strainers and tailpieces.
    - b. Provide integral sinks in epoxy countertops, bonded to countertops with invisible joint line.
    - c. Provide manufacturer's recommended adjustable support system for table- and cabinet-type installations.

## **PART 3 - EXECUTION**

### **3.1 INSPECTION**

- A. Substrate Verification: Verify adequacy of backing and support framing. Inspect subsurface to assure that backing is suitable for plumb, true and level installation.
- B. Casework Inspection: Inspect casework before installation for damage. Verify that casework will fit in intended locations.

### **3.2 INSTALLATION**

- A. Installation, General: Installation shall comply with all applicable WI standards and anchoring requirements and as detailed on Drawings.
- B. Placing and Securing Casework: Refer to anchoring requirements and details indicated on drawings.
  - 1. Install toe kick bases first and level before setting casework bodies.
  - 2. Set and secure casework in place, straight, rigid, plumb, and level.
  - 3. Secure toe kick bases and casework to floor using appropriate angles and anchors.
  - 4. Secure casework at top and bottom to each wall stud or to backing in wall with 3-inches wide head, #14 self-drilling sheet metal screws, spacing fasteners at 16-inches on center maximum.
  - 5. Conceal anchorage devices where possible.
  - 6. Countersink exposed fasteners.
- C. Joining Casework Components: Attach products with fasteners and fastening methods to units in concealed attachments. Use threaded steel concealed joint fasteners to align and secure adjoining counter tops.
- D. Fitting Casework: Carefully scribe casework, which is against other building materials, leaving gaps of 1/16-inch maximum. Do not use additional overlay trim for finishing joints and edges.
- E. Installing Countertops: Attach with screws or other approved mechanical fasteners and adhesive. Finish edges at sink cutouts with one coat of sealer.

### **3.3 INSTALLATION OF COUNTERTOPS**

- A. Comply with installation requirements in SEFA 2.3. Abut top and edge surfaces in one true plane with flush hairline joints and with internal supports placed to prevent deflection. Locate joints only where shown on Shop Drawings.
- B. Field Jointing: Where possible, make in same manner as shop-made joints using dowels, splines, fasteners, adhesives, and sealants recommended by manufacturer. Prepare edges in shop for field-made joints.

1. Use concealed clamping devices for field-made joints in plastic-laminate countertops. Locate clamping devices within **6 inches (150 mm)** of front and back edges and at intervals not exceeding **24 inches (600 mm)**. Tighten according to manufacturer's written instructions to exert a uniform heavy pressure at joints.
- C. Fastening:
1. Secure countertops, except for epoxy countertops, to cabinets with Z-type fasteners or equivalent, using two or more fasteners at each cabinet front, end, and back.
  2. Secure epoxy countertops to cabinets with epoxy cement, applied at each corner and along perimeter edges at not more than **48 inches (1200 mm)** o.c.
  3. Where necessary to penetrate countertops with fasteners, countersink heads approximately **1/8 inch (3 mm)** and plug hole flush with material equal to countertop in chemical resistance, hardness, and appearance.
- D. Provide required holes and cutouts for service fittings.
- E. Seal unfinished edges and cutouts in plastic-laminate countertops with heavy coat of polyurethane varnish.
- F. Provide scribe moldings for closures at junctures of countertop, curb, and splash with walls as recommended by manufacturer for materials involved. Match materials and finish to adjacent laboratory casework. Use chemical-resistant, permanently elastic sealing compound where recommended by manufacturer.
- G. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

### 3.4 INSTALLATION OF SINKS

- A. Comply with installation requirements in SEFA 2.3.
- B. Underside Installation of Epoxy Sinks: Use casework manufacturer's recommended adjustable support system for table- and cabinet-type installations. Set top edge of sink unit in sink and countertop manufacturers' recommended chemical-resistant sealing compound or adhesive and firmly secure to produce a tight and fully leakproof joint. Adjust sink and securely support to prevent movement. Remove excess sealant or adhesive while still wet and finish joint for neat appearance.
- C. Semiflush Installation of Stainless-Steel Sinks: Before setting, apply sink and countertop manufacturers' recommended sealant under rim lip and along top. Remove excess sealant while still wet and finish joint for neat appearance.
- D. Drop-in Installation of Epoxy Sinks: Rout groove in countertop to receive sink rim if not prepared in shop. Set sink in adhesive and fill remainder of groove with sealant or adhesive. Use procedures and products recommended by sink and countertop manufacturers. Remove excess adhesive and sealant while still wet and finish joint for neat appearance.

### 3.5 ADJUSTING AND CLEANING

- A. Adjusting: Adjust doors, drawers, hardware, fixtures and other moving or operating parts to function smoothly and correctly, without binding or squeaking.

- B. Sanitary cleaning, if necessary, will be performed by Owner.

**3.6 FIELD INSPECTIONS**

- A. Field Inspections: If directed by Project Manager or Owner's Representative, Contractor shall request and schedule field inspection of completed installation by the Woodworking Institute (WI) in accordance with WI Re-inspection service program. All fees, if any, of inspection shall be paid in accordance with provisions of the Conditions of the Contract.
- B. Report of Field Inspections: Provide copies of reports to field inspection to Project Inspector and Architect.

**- END OF SECTION -**



## - SECTION 12 3640 -

# STONE COUNTERTOPS

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## 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:
  - 1. Stone slab counters and fabricated countertops.

### 1.3 RELATED SECTIONS

- A. Section 01 74 19 "Materials Recycling & Waste Management".
- B. Section 01 81 13 "LEED Certification Requirements".
- C. Section 05 5000 "Metal Fabrications" for stainless steel edge trim.
- D. Section 06 1053 "Miscellaneous Rough Carpentry" for water-resistant plywood backer board material that stone slabs will be attached, or adhered.
- E. Section 06 4023 "Interior Architectural Woodwork" for miscellaneous millwork.
- F. Section 12 3200 "Manufactured Wood Casework" for cabinets and related millwork counters are installed onto.
- G. Division 22 for installation of plumbing fixtures and accessories.

### 1.4 SUBMITTALS

- A. Product Data: For the following:
  - 1. Each variety of stone. Include data on physical properties required by referenced ASTM standards.
  - 2. Stone accessories and other manufactured products.
- B. LEED Submittal:
  - 1. Product Data for Credit EQ 4.1: For adhesives and sealants, documentation including printed certification of VOC content.

2. Local/Regional Materials:
  - a. Sourcing location(s): Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.
  - b. Manufacturing location(s): Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
  - c. Product Value: Indicate dollar value of product containing local/regional materials; include materials cost only.
  - d. Product Component(s) Value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.
- C. Shop Drawings: Include plans, sections, details, and attachments to other work.
- D. Samples for Verification:
  1. For each stone type indicated, in sets of Samples not less than 12 inches (300 mm) square. Include two or more Samples in each set and show the full range of variations in appearance characteristics expected in completed Work.
- E. Sealant Compatibility Test Report: From sealant manufacturer, complying with requirements in Division 7 Section "Joint Sealants" and indicating that sealants will not stain or damage stone.
- F. Maintenance Data: For stone countertops to include in maintenance manuals. Include Product Data for stone-care products used or recommended by Installer, and names, addresses, and telephone numbers of local sources for products.

## 1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate stone countertops similar to that indicated for this Project and whose products have a record of successful in-service performance.
- B. Installer Qualifications: Fabricator of products.
- C. Source Limitations for Stone: Obtain each variety of stone from a single quarry with resources to provide materials of consistent quality in appearance and physical properties.
  1. Obtain each variety of stone from a single quarry, whether specified in this Section or in another Section of the Specifications.
  2. Make stone slabs available for Architect to examine for appearance characteristics.
    - a. Architect will select aesthetically acceptable slabs and will indicate aesthetically unacceptable portions of slabs.
    - b. Segregate slabs selected for use on Project and mark backs indicating approval.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store stone on wood A-frames or pallets with nonstaining separators and nonstaining, waterproof covers. Ventilate under covers to prevent condensation.

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## STONE COUNTERTOPS

## 1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions of construction to receive stone countertops by field measurements before fabrication.

## PART 2 - PRODUCTS

### 2.1 GRANITE SLAB

- A. Granite: Comply with ASTM C 615.
- B. Description: Uniform, medium-grained, black stone.
- C. Variety and Source: Subject to compliance with requirements, provide the following:
  - 1. Absolute Black #GR23P, distributed by Intertile Distributors, Inc., Milpitas, CA, tel: (408) 263-2300, [www.intertile.com](http://www.intertile.com). No substitutions allowed.
- D. Cut: Fleuri cut.
- E. Cut stone from contiguous, matched slabs in which natural markings occur.
- F. Finish: Polished.
- G. Match Architect's samples for color, finish, and other stone characteristics relating to aesthetic effects.

### 2.2 ADHESIVES, GROUT, SEALANTS, AND STONE ACCESSORIES

- A. General: Use only adhesives formulated for stone and ceramic tile and recommended by their manufacturer for the application indicated.
- B. Water-Cleanable Epoxy Adhesive: ANSI A118.3, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Bonsal, W. R. Company.
    - b. Bonstone Materials Corporation.
    - c. C-Cure.
    - d. Custom Building Products.
    - e. Laticrete International, Inc.
    - f. MAPEI Corp.
    - g. Summitville Tiles, Inc.
- C. Stone Adhesive: 2-part epoxy or polyester adhesive, formulated specifically for bonding stone to stone, with an initial set time of not more than 2 hours at 70 deg F (21 deg C), and with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).



1. Color: Match stone.
  2. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Epoxy Adhesive: Akemi North America; Akepox.
    - b. Epoxy Adhesive: Axson North America, Inc., Wood & Stone Company; Akabond Epoxy.
    - c. Epoxy Adhesive: Bonstone Materials Corporation; Touchstone Ratio Pac Clear Gel Epoxy.
    - d. Epoxy Adhesive: Bonstone Materials Corporation; Touchstone Last Patch.
    - e. Polyester Adhesive: Akemi North America; Platinum Clear Polyester Adhesive.
    - f. Polyester Adhesive: Axson North America, Inc., Wood & Stone Company; Wood & Stone Polyester.
    - g. Polyester Adhesive: Bonstone Materials Corporation; Gripstone L-200KG.
- D. Sealant for Countertops: Manufacturer's standard sealant of characteristics indicated below that comply with applicable requirements in Division 7 Section "Joint Sealants" and will not stain the stone it is applied to.
1. Single-component, neutral-curing silicone sealant.
  2. Color: As selected by Architect from manufacturer's full range.
  3. Use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. Stone Joint Splines: Stainless-steel or brass washers approximately 1 inch (25 mm) in diameter and of thickness to fit snugly in saw-cut kerf in edge of stone units.
- F. Stone Cleaner: Cleaner specifically formulated for stone types, finishes, and applications indicated, as recommended by stone producer and, if a sealer is specified, by sealer manufacturer. Do not use cleaning compounds containing acids, caustics, harsh fillers, or abrasives.
- G. Stone Sealer: Colorless, stain-resistant sealer that does not affect color or physical properties of stone surfaces, as recommended by stone producer for application indicated.
1. Available Manufacturers: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Bostik Findley Inc.
    - b. Custom Building Products.
    - c. Hillyard, Inc.
    - d. HMK Stone Care System.
    - e. Miracle Sealants Company.
    - f. Stone Care International Inc.
    - g. Summitville Tiles, Inc.

### 2.3 STONE FABRICATION, GENERAL

- A. Select stone for intended use to prevent fabricated units from containing cracks, seams, and starts that could impair structural integrity or function.

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### STONE COUNTERTOPS

1. Repairs that are characteristic of the varieties specified are acceptable provided they do not impair structural integrity or function and are not aesthetically unpleasing, as judged by Architect.
- B. Grade and mark stone for final locations to produce assembled countertop units with an overall uniform appearance.
- C. Fabricate stone countertops in sizes and shapes required to comply with requirements indicated, including details on Drawings and Shop Drawings.
  1. For granite, comply with recommendations in NBGQA's "Specifications for Architectural Granite."
  2. Clean sawed backs of stones to remove rust stains and iron particles.
  3. Dress joints straight and at right angle to face, unless otherwise indicated.
  4. Cut and drill sinkages and holes in stone for anchors, supports, and attachments.
  5. Provide openings, reveals, and similar features as needed to accommodate adjacent work.
  6. Finish exposed faces of stone to comply with requirements indicated for finish of each type of stone required and to match approved Samples and mockups. Provide matching finish on exposed edges of countertops, splashes, and cutouts.
- D. Carefully inspect finished stone units at fabrication plant for compliance with requirements for appearance, material, and fabrication. Replace defective units.

## 2.4 STONE COUNTERTOPS

- A. General: Comply with recommendations in MIA's "Dimension Stone - Design Manual."
- B. Nominal Thickness: Provide thickness indicated, but not less than 3/4 inches (19 mm). Gage backs to provide units of identical thickness.
- C. Edge Detail: 1-1/2-inch (38-mm) with eased edges.
- D. Splashes: Provide 3/4-inch- (20-mm-) thick backsplashes and end splashes, unless otherwise indicated.
  1. Height: As indicated.
  2. Top-Edge Detail: Straight, slightly eased at corner.
- E. Joints: Fabricate countertops without joints when possible, otherwise fabricate countertops in sections for joining in field, with joints at locations indicated and as follows:
  1. Bonded Joints: 1/32 inch (0.8 mm) or less in width.
  2. Splined Joints: Accurately cut kerfs in edges at joints for insertion of metal splines to maintain alignment of surfaces at joints where indicated. Make width of cuts slightly more than thickness of splines to provide snug fit. Provide at least three splines in each joint.
- F. Cutouts and Holes:
  1. Undercounter Fixtures: Make cutouts for undercounter fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
    - a. Provide 3/4-inch (20-mm) full bullnose edges projecting 3/8 inch (10 mm) into fixture opening.

2. Counter-Mounted Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
3. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates indicated to receive stone countertops and conditions under which stone countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
  1. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Advise installers of other work about specific requirements for placement of inserts and similar items to be used by stone countertop Installer for anchoring stone countertops. Furnish installers of other work with Drawings or templates showing locations of these items.
- B. Clean dirty or stained stone surfaces by removing soil, stains, and foreign materials before setting. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives. Allow stone to dry before installing.

### **3.3 CONSTRUCTION TOLERANCES**

- A. Variation from Level: Do not exceed 1/8 inch in 96 inches (3 mm in 2400 mm), 1/4 inch (6 mm) maximum.
- B. Variation in Plane at Joints (Lipping): Do not exceed 1/64-inch (0.4-mm) difference between planes of adjacent units.
- C. Variation in Line of Edge at Joints (Lipping): Do not exceed 1/64-inch (0.4-mm) difference between edges of adjacent units, where edge line continues across joint.

### **3.4 INSTALLATION OF COUNTERTOPS**

- A. General: Install countertops over plywood subtops with full spread of water-cleanable epoxy adhesive.
- B. Do necessary field cutting as stone is set. Use power saws with diamond blades to cut stone. Cut lines straight, true, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
- C. Set stone to comply with requirements indicated on Drawings and Shop Drawings. Shim and adjust stone to locations indicated, with uniform joints of widths indicated and with edges and faces aligned according to established relationships and indicated tolerances.

## **STONE COUNTERTOPS**

- D. Bond joints with stone adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.
  - 1. Install metal splines in kerfs in stone edges at joints where indicated. Fill kerfs with stone adhesive before inserting splines and remove excess immediately after adjoining units are drawn into position.
  - 2. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.
- E. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Use power saws with diamond blades to cut stone. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
- F. Install backsplash and end splash by adhering to countertops with stone adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Leave **1/16-inch (1.5-mm)** gap between splash and wall for filling with sealant. Use temporary shims to ensure uniform spacing.
- G. Apply sealant to joints; comply with Division 7 Section "Joint Sealants." Remove temporary shims before applying sealant.

### 3.5 ADJUSTING AND CLEANING

- A. In-Progress Cleaning: Clean countertops as work progresses. Remove adhesive, grout, mortar, and sealant smears immediately.
- B. Remove and replace stone countertops of the following description:
  - 1. Broken, chipped, stained, or otherwise damaged stone. Stone may be repaired if methods and results are approved by Architect.
  - 2. Defective countertops.
  - 3. Defective joints, including misaligned joints.
  - 4. Interior stone countertops and joints not matching approved Samples and mockups.
  - 5. Interior stone countertops not complying with other requirements indicated.
- C. Replace in a manner that results in stone countertops matching approved Samples and mockups, complying with other requirements, and showing no evidence of replacement.
- D. Clean stone countertops not less than six days after completion of installation, using clean water and soft rags. Do not use wire brushes, acid-type cleaning agents, cleaning compounds with caustic or harsh fillers, or other materials or methods that could damage stone.
- E. Sealer Application: Apply stone sealer to comply with stone producer's and sealer manufacturer's written instructions.

**- END OF SECTION -**



**- SECTION 12 4813 -**

**ENTRANCE FLOOR MATS & FRAMES**

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**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. Entrance carpet tiles in recessed metal frames

**1.3 RELATED SECTIONS**

- A. Section 03 3000 "Cast-in-Place Concrete" for slab depression grouting and filling for recessed mats and frames.

**1.4 SUBMITTALS**

- A. General: Submit in accordance with Section 01 3300.
- B. Product Data: Submit product data for floor mats.
- C. Shop Drawings:
  - 1. Submit shop drawings for floor mats.
    - a. Indicate layout including dimensions each mat unit, showing locations of joints between sections.
    - b. Submit full scale, dimensioned, detail drawings of frame and mat profiles, anchors, and internal connections.
    - c. Submit detail drawings of special accessory components not included in manufacturer's product data.
- D. Samples:
  - 1. Submit samples of specified frame material finish.
  - 2. Submit samples of mat indicating manufacturer's full range of available colors, textures, finishes, and patterns for selection by Architect.
  - 3. Submit tread insert samples indicating manufacturer's full range of available colors, textures, finishes, and patterns for selection by Architect.

- E. Submit following Informational Submittals: Manufacturer's instructions.
- F. Closeout Submittals:
  - 1. Submit under provisions of Section 01 7700.
  - 2. Operation and Maintenance Data. Submit manufacturer's printed recommended operation and maintenance data.

## 1.5 QUALITY ASSURANCE

- A. Single Source Responsibility:
  - 1. Furnish products from one manufacturer for entire Project, unless otherwise acceptable to Architect.
  - 2. Provide each floor mat as complete unit, including frame and accessory items necessary for proper installation and function.
- B. Regulatory Requirements: Ensure non-metal components comply with applicable portions of local, state, and federal codes, laws, and ordinances for flame spread and smoke developed indices.

## 1.6 PROJECT CONDITIONS

- A. Delay installation of floor mat frames until after building enclosure is complete and related interior finish work is complete.
- B. Recessed Frame: Install floor mat frames integrally with placement of concrete floor system.

# PART 2 - PRODUCTS

## 2.1 PRODUCTS AND MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide C/S Group "PediTred-G4" or a comparable product by one of the following:
  - 1. Balco, Inc.
  - 2. Consolidated Plastics Company, Inc.
  - 3. C/S Group.
  - 4. Pawling Corporation; Architectural Products Division.
  - 5. U.S. Mat & Rubber Corporation.

## 2.2 MATERIALS

- A. Extruded Aluminum: ASTM B221; alloy and temper as recommended by manufacturer for strength, corrosion resistance, and application of specified finish. Frame shall be a 1/2"(12.7mm) deep recessed frame in 6063-T5 aluminum alloy with 1/8" (3.2mm) wide exposed surface.

- B. Tread Inserts:
1. Cocoa Mat: Polypropylene fibers with 50/50 blend of 600/12-denier multi filament and 595/D1 monofilament. Each carpet fiber and monofilament shall be fusion-bonded to a rigid two-ply backing to prevent fraying.
  2. Mono-Tuft HD: Shall meet the Carpet and Rug Institute's standard for good indoor air quality. Fibers shall include a minimum of 100, 12 mil monofilament fibers per square inch and colorfast, solution-dyed 100 percent nylon. Each carpet fiber shall be fusion bonded to a rigid two-ply backing to prevent fraying and supplied in continuous splice-free lengths. Anti-static carpet fiber shall contain antimicrobial additive and be treated with Scotchguard to reduce soiling. Carpet weight shall be 330oz./yd<sup>2</sup>.
  3. Colors, Textures, and Patterns: As selected by Architect from manufactures standard carpet types and colors, if not indicated on finish schedule.
- C. Mat Size: As indicated
- D. Adhesive: Volatile Organic Compound: 3 g/L, maximum
- E. Latex leveling screed by installer to ensure level base.
- F. FABRICATION
- G. Frames:
1. Fabricate manufacturer's standard frame profiles to fit size and style of mat for permanent installation.
  2. Fabricate manufacturer's standard frame profiles to fit size and style of mat for permanent installation in shallow, level bottom recess in subfloor.
  3. Fabricate frame members in single lengths or, where dimensions exceed maximum available lengths, provide minimum number of pieces possible with hairline joints equally spaced, and with pieces spliced together by means of straight connecting pins.
  4. Cope or miter and rigidly connect frame corners and intersections with stainless steel fasteners or by welding.
  5. Mill finish frames in contact with concrete to be primer coated.

## 2.3 FINISHES

- A. Aluminum Surfaces: Clear anodized finish.
- B. Aluminum Surfaces in Contact With Concrete or Grout: Shop coat with zinc chromate primer.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine conditions and proceed with work when substrates are ready.
- B. Verify preparatory work by other trades is complete.



### 3.2 PREPARATION

- A. Assemble frame rails and securely fasten sections together.

### 3.3 INSTALLATION

- A. Install mat and frames in accordance with manufacturer's instructions and approved shop drawings.
- B. Install frames in level and accurate plane, square, and free from warp or twist while maintaining dimensional tolerances and alignment with surrounding surfaces.
- C. Recessed Frame:
  - 1. Provide necessary shims, spacers, and anchorages to position and hold frame securely in position during placement of grout.
  - 2. Coordinate with other trades as required.
- D. Installation Tolerances:
  - 1. Horizontal variation of frame from dimensioned location: Plus or minus 1/4 inch.
  - 2. Maximum perimeter gap between mat and frame: 3/16 inch.
  - 3. Maximum offset between adjacent members at joints: 1/32 inch.
  - 4. Vertical variation from plane of floor:
    - 5. Hard surfaced floors: Plus 0 to minus Minus 1/8 inch from finished floor surface.
    - 6. Carpeted floors: Plus Plus 1/4 to minus 0 inch from finished subfloor surface.
    - 7. Maximum variation in subfloor flatness: 1/8 inch in 10'-0".
- E. Carpet Mat Installation: Set in adhesive provided by manufacturer. Install beveled nosing to terminate at dissimilar materials.
- F. Rubber Mat Installation: Install rubber tiles in pattern indicated on Drawings. Set in adhesive provided by manufacturer. Install beveled nosing to terminate at dissimilar materials.

### 3.4 CLEANING

- A. Clean mats as recommended by manufacturer. Do not use materials or methods which may damage metal finish, insert surfaces, or surrounding construction.
- B. Clean recesses to remove dust and debris before final installation of mat.

### 3.5 PROTECTION

- A. Protect finished work.
- B. Recessed Installation:
  - 1. After completion of frame installation, provide temporary filler of plywood or other suitable material in mat recesses.
  - 2. Cover exposed frames to protect from traffic damage during construction.

- C. After fitting, remove and store mat until near Substantial Completion of Project to protect from damage.

**- END OF SECTION -**



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## - SECTION 13 4900 -

# RADIATION PROTECTION

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## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

- A. Section Includes:
  - 1. Lead sheet, strip, and plate.
  - 2. Lead glass.
  - 3. Lead-lined building materials and products including the following:
    - a. Gypsum board.
    - b. Steel hollow-metal doors and door frames.
    - c. Wood doors.
    - d. Observation-window frames.
  - 4. Informational signs.

### 1.3 RELATED SECTIONS

- A. Section 01 74 19 "Materials Recycling & Waste Management".
- B. Section 01 81 13 "LEED Certification Requirements".
- C. Section 03 3000 "Cast-in-Place Concrete" for concrete floor topping over lead shielding in concrete slabs.
- D. Section 08 7111 "Door Hardware" for door hardware for lead-lined steel hollow-metal doors.
- E. Section 09 2900 "Gypsum Board" for metal framing and furring for lead-lined gypsum board and for finishing materials, accessories, and trim applied to lead-lined gypsum board.
- F. Sections 09 9123 "Interior Painting" for field finishing doors and frames.

#### 1.4 DEFINITIONS

- A. Lead Equivalence: The thickness of lead that provides the same attenuation (reduction of radiation passing through) as the material in question under the specified conditions.
  - 1. Lead equivalence specified for materials used in diagnostic x-ray rooms is as measured at 100 kV unless otherwise indicated.

#### 1.5 PERFORMANCE REQUIREMENTS

- A. Provide materials and workmanship, including joints and fasteners, that maintain continuity of radiation protection at all points and in all directions equivalent to materials specified in thicknesses and locations indicated.
  - 1. Materials, thicknesses, and configurations indicated are based on radiation protection design prepared by Owner's radiation health physicist. This design is available to Contractor on request.
- B. Lead-Lined Assemblies: Unless otherwise indicated, provide lead thickness in doors, door frames, window frames, penetration shielding, joint strips, film transfer cabinets, and other items located in lead-lined assemblies not less than that indicated for assemblies in which they are installed.
- C. Lead Glazing: Unless otherwise indicated, provide lead equivalence not less than that indicated for assembly in which glazing is installed.

#### 1.6 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittal:
  - 1. Certificates for Credit MR 7: Chain-of-custody certificates certifying that wood veneer on doors complies with forest certification requirements. Include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.
    - a. Include statement indicating costs for certified wood veneer doors.
- C. Shop Drawings: Show layout of radiation-protected areas. Indicate lead thickness or lead equivalence of components. Show components and installation conditions not fully dimensioned or detailed in product data.
  - 1. Show ducts, pipes, conduit, and other objects that penetrate radiation protection; include details of penetrations.
- D. Other Action Submittals:
  - 1. Schedule: Provide a schedule of observation windows, doors and frames prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.
- E. Field quality-control reports.
- F. Operation and Maintenance Data: For neutron-shielding doors to include in operation and maintenance manuals.

### RADIATION PROTECTION

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- G. Warranty: Sample of special warranty.

## 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. Source Limitations: Obtain each type of radiation protection product from single source from single manufacturer unless otherwise indicated.
- C. Forest Certification: Provide wood veneers for doors produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."
- D. Fire-Rated Door and Frame Assemblies: Comply with Section 08 1113 "Hollow Metal Doors and Frames" and Section 08 1416 "Flush Wood Doors".
- E. Glazing: Comply with requirements in Section 08 8000 "Glazing."
- F. Preinstallation Conference: Conduct conference at Project site.
  - 1. Review methods and procedures related to radiation protection including, but not limited to, the following:
    - a. Sequence and schedule of radiation protection work in relation to other work.
    - b. Supplementary lead shielding at duct, pipe, and conduit penetrations of radiation protection.
    - c. Methods of attaching other construction and equipment to lead-lined finishes.
    - d. Notification procedures for work that requires modifying radiation protection.
    - e. Requirements for field quality control.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Lead-Lined Gypsum Panels: Neatly stack panels flat to prevent deformation.
- B. Lead-Lined Steel Doors and Frames: Comply with requirements in Section 08 1113 "Hollow Metal Doors and Frames" for delivery, storage, and handling.
- C. Lead-Lined Steel Doors and Frames: Deliver doors and frames cardboard wrapped or crated to provide protection during delivery and storage. Inspect for damage on delivery. Minor damage may be repaired provided the refinished repair matches new work and is approved by Architect; otherwise, remove and replace damaged items as directed.
- D. Lead-Lined Wood Doors: Comply with manufacturer's written instructions and requirements in WDMA I.S.1-A.
  - 1. Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheeting.
  - 2. Mark each door on top and bottom rail with opening number used on Shop Drawings.



## 1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install radiation protection until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

## 1.10 WARRANTY

- A. Comply with requirements in Section 08 1416 "Flush Wood Doors."

# PART 2 - PRODUCTS

## 2.1 MATERIALS

- A. Lead Sheet, Strip, and Plate: ASTM B 749, alloy UNS No. L51121 (chemical-copper lead).
- B. Borated Polyethylene: Manufactured specifically for neutron shielding and containing not less than 5 percent boron.
- C. Lead Glass: Lead-barium, polished float glass containing not less than 60 percent heavy metal oxides, including not less than 48 percent lead oxide by weight.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Amerope Enterprises, Inc.
    - b. McGrory Glass, Inc.
    - c. Schott North America, Inc.
  - 2. Safety Glass: Laminated float glass.
    - a. Outer Lite: Clear float glass; thickness as indicated.
    - b. Interlayer: Clear polyvinyl butyral or cured resin of manufacturer's standard thickness indicated with a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after laminating glass lites and installation.
    - c. Inner Lite: Lead-barium, polished float glass; thickness as indicated.
- D. Lead-Lined Gypsum Board: **5/8-inch- (16-mm-)** thick gypsum board complying with Section 09 29000 "Gypsum Board," of width and length required for support spacing and to prevent cracking during handling, and with a single sheet of lead laminated to the back of the board.
  - 1. Provide lead sheet lining the full width of board and length necessary to extend from floor to 84 inches (2133 mm) above floor.
  - 2. Provide 3-inch- (75-mm-) wide lead strips for wrapping metal stud flanges.
  - 3. Provide 2-inch- (50-mm-) wide lead strips for backing joints.
  - 4. Provide 5/8-inch (16-mm) lead disks for covering screw heads.

## RADIATION PROTECTION

5. Provide lead-headed nails for fastening gypsum board, accessories, and trim to wood members.
- E. Accessories and Fasteners: Provide manufacturer's standard fasteners and accessories as required for installation, maintaining same lead equivalence as rest of system.
- F. Asphalt Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.
- G. Asphalt Felt: ASTM D 226.

## 2.2 LEAD-LINED STEEL HOLLOW-METAL DOORS

- A. General: Steel doors complying with ANSI/NAAMM-HMMA 861, except with a single continuous sheet of lead of thickness not less than that required for partition in which door is installed and extending from top to bottom and edge to edge, installed either between back-to-back stiffeners or between stiffeners and stop face of door.
  1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Deronde Products.
    - b. Karpen Steel Custom Doors & Frames.
    - c. A & L Shielding Inc.
    - d. El Dorado Metals, Inc.
    - e. New Shield.
    - f. Ray-Bar Engineering Corp.
  2. Line inverted channels at top and bottom of doors with lead sheet of same thickness used in door and close with filler channels to provide flush top and bottom edges.
  3. Shield cutouts for locksets with lead sheet of same thickness used in door. Lap lining of cutouts with door lining 1 inch (25 mm).
  4. Prepare doors to receive observation windows and louvers; cut and trim openings through doors in factory. Provide removable stops for glazed openings.
  5. Provide lead-lined astragals for pairs of doors.
  6. Factory fit doors to suit frame-opening sizes indicated with 1/16-inch (1.5-mm) clearance at heads and jambs and minimum clearance at bottom.
  7. Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
- B. Lead Door Louvers: Provide louvers with 30 percent free area, of sizes and types indicated. Fabricate from formed-lead sheet or lead extrusions of not less than lead thickness required for door in which louver is installed. Fabricate louvers to be lightproof with fixed maze-type blades that maintain required lead equivalence at all points and in all directions. Factory fit and assemble louvers in doors before shipping to Project site.

## 2.3 LEAD-LINED STEEL HOLLOW-METAL DOOR FRAMES

- A. General: Steel door frames complying with ANSI/NAAMM-HMMA 861, except 0.0667 inch (1.7 mm) thick, and lined with lead sheet of thickness not less than that required for doors and walls where frames are used.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Deronde Products.
  - b. Karpen Steel Custom Doors & Frames.
  - c. Accurate Radiation Shielding, Inc.
  - d. A & L Shielding Inc.
  - e. El Dorado Metals, Inc.
  - f. Fluke Biomedical; Radiation Management Services.
  - g. Mayco Industries; a Metalico company.
  - h. NELCO, Inc.
  - i. New Shield.
  - j. Radiation Protection Products, Inc.
  - k. Ray-Bar Engineering Corp.
2. Provide additional reinforcements and internal supports to adequately carry the weight of lead-lined doors. Install reinforcements and supports before installing lead lining.
3. Form lead sheet to match frame contour, continuous in each jamb and across the head, lapping the stops. Form lead shields around areas prepared to receive hardware. Fabricate lead lining wide enough to maintain an effective lap with lead of adjacent shielding.
4. Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.

## 2.4 LEAD-LINED WOOD DOORS

- A. General: Flush solid-core wood doors with lead lining, thickness not less than that required for partition in which door is installed.
  1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Algoma Hardwoods, Inc.
    - b. Eggers Industries; Architectural Door Div.
    - c. Marshfield DoorSystems, Inc.
    - d. Oshkosh Door Company.
    - e. Vancouver Door Company.
    - f. V-T Industries Inc.
  2. Door Construction: Veneer face, five ply, bonded particleboard core.
  3. Lead Lining: One or more continuous sheets of lead extending from top to bottom and edge to edge, constructed either in the core or between the core and faces, at manufacturer's option.
  5. Comply with Section 08 1416 "Flush Wood Doors" for grade, faces, veneer matching, fabrication, finishing, and other requirements unless otherwise indicated.
  6. Quality Standard: WI's "Manual of Millwork."
  7. Shield cutouts for locksets with lead sheet of same thickness used in door. Lap lining of cutouts with door lining.
  8. Prepare doors to receive observation windows and louvers; cut and trim openings through doors in factory. Provide removable wood stops for glazed openings.

## RADIATION PROTECTION

9. Provide lead-lined astragals for pairs of doors.
10. Factory fit doors to suit frame openings indicated with 1/16-inch (1.5-mm) clearance at heads and jambs and minimum clearance at bottom. Factory machine doors for hardware not surface applied.

- B. Lead Door Louvers: Provide louvers with 30 percent free area, of sizes and types indicated. Fabricate from formed-lead sheet or lead extrusions of not less than lead thickness required for door in which louver is installed. Fabricate louvers to be lightproof with fixed maze-type blades that maintain required lead equivalence at all points and in all directions. Factory fit and assemble louvers in doors before shipping to Project site.

## 2.5 LEAD-LINED OBSERVATION-WINDOW FRAMES

- A. General: Fabricate from 0.043-inch- (1.1-mm-) thick, formed-steel sheet or 0.064-inch- (1.6-mm-) thick aluminum extrusions with mitered corners, welded or bolted with concealed fasteners.
1. Line with lead sheet formed to match frame contour, continuous in each jamb and across head and sill, lapping the stops, and fabricated wide enough to maintain an effective lap with lead of adjoining assemblies.
  2. Construct so lead lining overlaps glazing material perimeter by at least 3/8 inch (9.5 mm) and provide removable stops.
  3. Form sill with an opening for sound transmission. Offset sound passage to make opening lightproof and to maintain required lead equivalence at all points and in all directions.

## 2.6 INFORMATIONAL SIGNS

- A. Informational Signs, General: Comply with Section 10 1400 "Signage."
1. Color: As selected by Architect from manufacturer's full range of colors.
  2. Provide copy indicated or as directed. Provide signs of sufficient size to contain required information.
  3. Indicate lead equivalence in millimeters and heights of radiation protection in inches (millimeters).
- B. Informational Signs, General: Fabricate signs by engraving lettering in high-pressure-laminate engraving stock with contrasting face and core. Machine engrave copy using high-speed cutters mechanically positioned by master templates for accurately formed letters, numbers, and symbols.
1. Color: As selected by Architect from manufacturer's full range of colors.
  2. Provide copy indicated or as directed. Provide signs of sufficient size to contain required information.
  3. Indicate lead equivalence in millimeters and heights of radiation protection in inches (millimeters).
- C. Rooms Where the Level of Protection Is Uniform Throughout: Provide one sign for each room indicating lead equivalence of partitions, ceilings, floors, doors, and other portions of radiation protection enclosure. Indicate height of radiation protection above floor or indicate that partitions are radiation protected to full height.

- D. Rooms Where the Level of Protection Is Not Uniform Throughout: Provide one sign for each room with different lead equivalences in different locations. Indicate, in tabular form, lead equivalence of each wall, partition, ceiling, floor, door, and window. Indicate height of radiation protection above floor or indicate that partitions are radiation protected to full height. Indicate where lead equivalence changes or is not continuous.
- E. Rooms Where Some Partitions Are without Radiation Protection: Provide one sign for each partition that contains radiation protection and indicate its lead equivalence. Indicate height of radiation protection above floor or indicate that partitions are radiation protected to full height.
- F. Rooms Where Only the Door Has Radiation Protection: Provide one sign for each door indicating its lead equivalence.

## 2.7 DOOR AND DOOR FRAME FABRICATION

- A. Hardware Preparation: Factory prepare doors and frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Section 08 7111 "Door Hardware."

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates in areas to receive radiation protection, with Installer present, for compliance with requirements, installation tolerances, and other conditions affecting performance of radiation protection.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Concrete Surfaces: Proceed with installation only after surfaces are clean, dry, and free of depressions and sharp projections that could damage or penetrate lead sheet.

## 3.2 INSTALLATION OF LEAD SHEETS IN CONCRETE FLOOR SLABS

- A. Apply a coat of asphalt mastic or paint to concrete surfaces before installing lead sheet.
- B. Before installing floor lead sheet, place lead strips not less than **7 inches (175 mm)** wide under the base of vertical wall protection. Extend lead strips approximately **3 inches (75 mm)** into the shielded room area.
- C. Lead Sheet, **1/8 Inch (3 mm)** Thick or Less: Install in a single layer with a **2-inch (50-mm)** minimum lap at joints.
- D. Lead Sheet More Than **1/8 Inch (3 mm)** Thick: Install in two or more layers with a **2-inch (50-mm)** minimum lap at joints, or in a single layer with joints butted and covered with a **4-inch (100-mm-)** wide lead strip of same thickness.
- E. Extend lead sheet at least **12 inches (300 mm)** beyond radiation protection in walls of room.

- F. In floor slabs above shielded rooms where lead sheet is indicated, extend lead sheet at least **12 inches (300 mm)** beyond radiation protection in walls of room below.
- G. At door openings, extend lead sheet at least **12 inches (300 mm)** beyond radiation protection in walls and at least **12 inches (300 mm)** beyond door opening on both sides except where lead-lined thresholds are provided.
- H. After installation, apply two coats of asphalt coating on top surface of lead sheet and protect from damage until concrete topping is placed.

### 3.3 INSTALLATION OF LEAD-LINED GYPSUM BOARD

- A. Install with long edge parallel to supports and lead lining facing supports. Provide blocking at end joints.
- B. Fastening to Metal Supports: Use steel drill screws spaced as recommended in writing by gypsum board manufacturer. Install lead strips covering face of framing and wrap around flange to cover points of screws.
  - 1. Where possible, install lead-lined gypsum board before installing gypsum board on other side of partition, and do not fold lead strips back over inside of flange until after lead-lined gypsum board is applied.
  - 2. Apply lead disks recessed flush with surface of board over heads of screws securing trim.
- C. Fastening to Metal Supports: Use steel drill screws spaced as recommended in writing by gypsum board manufacturer. Apply lead disks over screw heads and recess flush with surface of board.
  - 1. Install lead strips, **1-1/2 inches (38 mm)** wide minimum and same thickness as lead lining, to face of supports and blocking where joints occur. Secure lead strips with construction adhesive. Provide shims at intermediate supports.
  - 2. Apply lead disks recessed flush with surface of board over heads of screws securing trim.
- D. Fastening to Wood Supports: Use lead-headed nails spaced as recommended in writing by gypsum board manufacturer. Drill pilot holes to prevent deforming nails or distorting board. Drive nail heads slightly below exposed surface.
  - 1. Install lead strips, **1-1/2 inches (38 mm)** wide minimum and same thickness as lead lining, to face of supports and blocking where joints occur. Secure lead strips with construction adhesive. Provide shims at intermediate supports.
  - 2. Fasten accessories and trim to wood supports with lead-headed nails as specified above for fastening gypsum board.
- E. Two-Layer System: Apply a facing sheet of gypsum board vertically over base sheet using laminating adhesive recommended in writing by gypsum board manufacturer. Offset joints in finish layer from joints in base layer and fasten at top and bottom of sheet to support finish panel until adhesive has set.
  - 1. Locate fasteners above ceiling or behind wall base and cover fasteners with lead disks recessed flush with surface of board.
- F. Openings: Extend lead-lined gypsum board into frames of openings, lapping lead lining with lead frames or frame linings at least **1 inch (25 mm)**. Arrange board around openings so neither horizontal nor vertical joints occur at corners of openings.

- G. Install control and expansion joints where indicated, with appropriate trim accessories. Install lead strip on face of framing, extending across joint, and lap with lead lining of gypsum board.

### 3.4 INSTALLATION OF LEAD-LINED DOORS AND DOOR FRAMES

- A. Install lead-lined steel doors and door frames according to Section 08 1113 "Hollow Metal Doors and Frames."
  - 1. Apply a coat of asphalt mastic or paint to lead lining in door frames where lead will come in contact with masonry or grout.
- B. Install lead-lined wood doors according to Section 08 1416 "Flush Wood Doors."
- C. Glazing: Comply with installation requirements in Section 08 8000 "Glazing" and with door manufacturer's written instructions.
- D. Frames: Comply with HMMA 840 unless otherwise indicated. Except for frames located in existing walls or partitions, place frames before constructing walls. Set frames accurately in position, plumb, and brace securely until permanent anchors are set.
  - 1. Provide three anchors per jamb, located adjacent to hinge on hinge jamb and at corresponding heights on strike jamb.
  - 2. In masonry construction, use wire or T-strap anchors and apply a coat of asphalt mastic or paint to lead lining where lead will come in contact with masonry or grout.
  - 3. In metal stud construction, use wall anchors attached to studs with screws.
  - 4. In wood stud construction, use strap anchors attached to studs with screws.
- E. Lead Lining of Frames: Line inside of frames with lead of thickness not less than that required in doors and walls where frames are used. Form lead to match frame contour, continuous in each jamb and across the head, lapping the stops. Form lead shields around areas prepared to receive hardware. Lap lining over lining in walls at least **1 inch (25 mm)**.
- F. Install doors in frames level and plumb, aligned with frames and with uniform clearance at each edge.
- G. Line astragals with lead sheet.
- H. Hardware: Line covers, escutcheons, and plates to provide effective shielding at cutouts and penetrations of frames and doors. See Section 08 7111 "Door Hardware" for other installation requirements.
- I. Touch up damaged finishes with compatible coating after sanding smooth.
- J. Operation: Rehang or replace doors that do not swing or operate freely. Check and readjust operating hardware items, leaving doors and frames undamaged and in proper operating condition.

### 3.5 INSTALLATION OF LEAD-LINED OBSERVATION WINDOWS

- A. Install observation windows according to manufacturer's written installation instructions.
  - 1. Apply a coat of asphalt mastic or paint to lead lining in frames where lead will come in contact with masonry or grout.

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## RADIATION PROTECTION

- B. Install windows level, plumb, square, true to line, and anchored securely in place to structural support.
- C. Install leaded side of frame on radiation side of wall. Lap lead lining of frames over lining in walls at least **1 inch (25 mm)**.
- D. Glazing: Comply with installation requirements in Section 08 8000 "Glazing" and with manufacturer's written instructions.

### **3.6 INSTALLATION OF PENETRATING ITEMS**

- A. At penetrations of lead linings, provide lead shields to maintain continuity of protection.
- B. Provide lead linings, sleeves, shields, and other protection in thickness not less than that required in assembly being penetrated.
- C. Secure shields at penetrations using adhesive or wire ties but not penetrating fasteners unless indicated on Drawings.
- D. Film Transfer Cabinets: Where film transfer cabinets occur in lead-lined partitions, line wall flange with lead sheet of same thickness as required for partition where it is located.
- E. Outlet Boxes and Conduit: Cover or line with lead sheet lapped over adjacent lead lining at least **1 inch (25 mm)**. Wrap conduit with lead sheet for a distance of not less than **10 inches (250 mm)** from box.
- F. Duct Openings: Unless otherwise indicated, line or wrap ducts with lead sheet for distance from partition/ceiling equal to three times the largest opening dimension. Lap lead sheet with adjacent lead lining at least **1 inch (25 mm)**.
- G. Piping: Unless otherwise indicated, wrap piping with lead sheet for a distance of not less than **10 inches (250 mm)** from point of penetration.

### **3.7 FIELD QUALITY CONTROL**

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections after radiology equipment has been installed and placed in operating condition.
- B. Correct deficiencies in or remove and replace radiation protection that inspection reports indicate does not comply with specified requirements.

### **3.8 PROTECTION**

- A. Lock radiation-protected rooms once doors and locks are installed and limit access to only those persons performing work in the rooms.

**- END OF SECTION -**





## **DIVISION 14 – CONVEYING SYSTEMS**

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## **- SECTION 14 2400 -**

# **HYDRAULIC ELEVATORS**

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## **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:
  - 1. Provide hydraulic elevators complete as shown and specified.

### **1.3 RELATED WORK INTERFACED WITH THIS SECTION**

- A. Life Safety or Public Address Speakers: Furnished by others; wire from machine room to car, accommodations and installation in car canopy by this Section.
- B. Key Cylinders: Furnished by Owner; installed under this Section.

### **1.4 QUALITY ASSURANCE**

- A. Requirements of Regulatory Agencies:
  - 1. Codes: In accordance with the latest applicable edition requirements of the following and as specified:
    - a. A.D.A.: Americans with Disabilities Act.
    - b. ASME: American Society of Mechanical Engineers - A17.1; Safety Code for Elevators and Escalators.
    - c. CBC: Title 24; California Building Codes.
    - d. CCR: Titles 8; California Code of Regulations.
    - e. NEC: National Electric Code.
    - f. UBC: Uniform Building Code.
    - g. All local codes, which govern.
  - 2. Permits: Arrange and pay for inspections by governing authorities and obtain operating permits.

## 1.5 SUBMITTALS

- A. Shop Drawings: Submit as required by the Owner's Representative. The Owner's Representative reserves the right to require any details of any portion of the equipment.
  - 1. Layouts: Plan and section of hoistways, pits and machinery spaces; include impact and static loads imposed on building structure location of hoistway ventilation and required clearances around equipment.
  - 2. Details: Submit details of cabs, fixtures and entrances.
  - 3. Data: Indicate on layouts or separate data sheets; machine spaces heat release, power requirements, conduit runs outside of hoistways and machine rooms, car and counterweight roller guides and door operators.
- B. Samples: Provide samples of materials and finishes exposed to public view and additional, if specifically requested, 6 inch x 6 inch panels, 12 inch lengths or full size if smaller, as applicable.
- C. Operating Instructions: Submit manufacturer's literature describing system operations and special operations as specified.

## 1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Protect equipment during transportation, erection and construction. Store under cover to prevent damage due to weather conditions. Replace damaged materials.

## 1.7 SEQUENCING AND SCHEDULING

- A. Schedule and be responsible for coordinating related work with other trades to avoid omissions and delays in job progress.

## 1.8 WARRANTY

- A. Provide special project warranty, signed by Contractor, Installer and Manufacturer, agreeing to replace/repair/restore defective materials and workmanship of elevator work which may develop within one (1) year from final date of completion and acceptance of the entire installation. "Defective" is hereby defined to include, but not by way of limitation, operation or control system failures, performances below required minimums, excessive wear, unusual deterioration or aging of materials or finishes, unsafe conditions, the need for excessive maintenance, abnormal noise or vibration and similar unusual, unexpected and unsatisfactory conditions.
- B. Initial Maintenance Service: Beginning at Substantial Completion, provide one year's full maintenance service by skilled employees of elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.
- C. Should any elevator become inoperative, respond within two hours, repair within 24 hours of notification of such failure. Breakdown of major components shall be completed and service restored within 72 hours

**1.9 WARRANTY**

- A. Special Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to repair, restore, or replace defective elevator work within specified warranty period.
1. Warranty Period: One year from date of Substantial Completion.

**1.10 MAINTENANCE SERVICE**

- A. Initial Maintenance Service: Beginning at Substantial Completion, provide one year's full maintenance service by skilled employees of elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.
1. Perform maintenance, including emergency callback service, during normal working hours.
  2. Include 24-hour-per-day, 7-day-per-week emergency callback service.
    - a. Response Time: Two hours or less.
- B. Continuing Maintenance Proposal: Provide a continuing maintenance proposal from Installer to Owner, in the form of a standard two-year maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

**PART 2 - PRODUCTS**

- A. Provide manufacturer's standard elevator systems. Where components are not otherwise indicated, provide standard components published by manufacturer as included in standard pre-engineered elevator systems and as required for complete system.
- B. Basis-of-Design Product: The design based on IDH-M-H1 Hydraulic Elevator manufactured by Mitsubishi Electric & Electronics USA, Inc, located in Cypress, CA, tel: (714) 220-2500 or (510) 430-2567, web: [www.mitsubishielevator.com](http://www.mitsubishielevator.com). Subject to compliance with requirements, provide the named product or a comparable product by one of the following manufactures:
1. Fujitec Elevator Company.
  2. KONE Elevator Company.
  3. Otis Elevator Company.
  4. Schindler Elevator Corporation
  5. ThyssenKrupp Elevator Company.

**2.2 SYSTEMS AND COMPONENTS**

- A. General: Provide manufacturer's standard elevator systems. Where components are not otherwise indicated, provide standard components published by manufacturer as included in standard preengineered elevator systems and as required for complete system.
- B. Pump Units: Positive-displacement type with a maximum of 10 percent variation between no load and full load and with minimum pulsations. Provide the following:

1. Submersible pump, with submersible squirrel-cage induction motor, suspended inside oil tank from vibration isolation mounts.
  2. Provide motor with wye-delta or solid-state starting
- C. Piping: Provide size, type, and weight piping recommended by manufacturer, and provide flexible connectors to minimize sound and vibration transmissions from power unit.
1. Casing for Underground Piping: PVC pipe complying with ASTM D 1785, joined with PVC fittings complying with ASTM D 2466 and solvent cement complying with ASTM D 2564.
- D. Hydraulic Fluid: Provide Phillips 66, Point Anti-Wear, ISO 32 or approved equal for hydraulic elevator use.
- E. Inserts: Furnish required concrete and masonry inserts and similar anchorage devices for installing guide rails, machinery, and other components of elevator work where installation of devices is specified in another Section.
- F. Protective Cylinder Casing: PVC or HDPE pipe casing complying with ASME A17.1, of sufficient size to provide not less than **1-inch (25-mm)** clearance from cylinder and extending above pit floor. Provide means to monitor casing effectiveness to comply with ASME A17.1.
- G. Car Frame and Platform: Welded steel units.
- H. Guides: Provide either roller guides or sliding guides at top and bottom of car and counterweight frames. If sliding guides are used, provide guide-rail lubricators or polymer-coated, nonlubricated guides.
- I. Controller: As standard with approved manufacturer; overload relays in three legs of power circuit and in loop circuit; cabinets with NEMA-1 enclosures and doors arranged with locks or mechanical latches. Provide permanently marked symbols or letters identical to those on wiring diagrams adjacent to each component.

### 2.3 OPERATION SYSTEMS

- A. General: Provide manufacturer's standard microprocessor operation system for each group of elevators as required to provide type of operation system indicated.
- B. Single-Car Auxiliary Operations: In addition to primary operation system features, provide the following operational features for elevators where indicated:
1. Battery-Powered Lowering: When power fails, car is lowered to the lowest floor, opens its doors, and shuts down. System includes rechargeable battery and automatic recharging system.
- C. Group Auxiliary Operations: In addition to primary operation system features, provide the following operational features for elevators and elevator groups where indicated:
1. Battery-Powered Lowering: If power fails, cars that are at a floor remain at that floor, open their doors, and shut down. Cars that are between floors are lowered to a preselected floor, open their doors, and shut down. Cars that are below the preselected floor are lowered to the next lower floor, open their doors, and shut down. System includes rechargeable battery and automatic recharging system.
  2. Priority Service: Service is initiated by a keyswitch at designated floors. One elevator is removed from group operation and directed to the floor where service was initiated. On

## HYDRAULIC ELEVATORS

arriving at the floor, elevator opens its doors and parks and a lighted sign directs passengers to exit elevator. Car is placed in operation by selecting a floor and pressing door close button or by operating keyswitch to put car in independent service. After responding to floor selected or being removed from independent service, car is returned to group operation. If car is not placed in operation within a preset time after being called, it is returned to group operation.

3. Independent Service: Keyswitch in car control station removes car from group operation and allows it to respond only to car calls. Key cannot be removed from keyswitch when car is in independent service. When in independent service, doors close only in response to door close button.

## 2.4 DESCRIPTION OF SYSTEMS

- A. Passenger Elevator #1, Bldg 5N:
  1. Type: Holed, hydraulic, under-the-car single cylinder
  2. Capacity: 4000 Pounds
  3. Speed: 125 FPM
  4. Stops: 3
  5. Openings: 3 in line
  6. Travel: As Shown
  7. Control: MotionControl Engineering or equivalent
  8. Operation: Duplex Selective Collective
  9. Machine Location: Location: Adjacent, 1st Floor
  10. Special Operations:
    - a. Independent Service
    - b. Fire Emergency Service
    - c. Emergency Battery Lowering
  11. Car Enclosure Type: Passenger
    - a. Platform Size: 8' - 0" W by 6' - 2" D by 9' - 0" H
    - b. Inside Clear: 7' - 8" W by 5' - 4" D by 7' - 11" H
  12. Signals and Fixtures Design as Specified
    - a. Car Operating Panels: 1 Per Car
    - b. Car Position Indicator: Integral with Car Panel
    - c. Communication Sys.: Integral with Car Panel
    - d. Service Cabinet: Integral with Car Panel
    - e. Hall Pushbuttons: 1 Riser
    - f. Hall Lanterns: All Floors
  13. Passenger Entrance Type Center Open, Single Speed
    - a. Size: 4' - 0" W by 7' - 0" H
    - b. Frames
      - 1) Main Floor: Stainless Steel
      - 2) Typical Floors: Stainless Steel
  14. Doors
    - a. Main Floor: Stainless Steel
    - b. Typical Floors: Stainless Steel



15. Sills
    - a. Main Floor: Nickel silver, polished
    - b. Typical Floors: Nickel silver, polished
  16. Cab: Steel shell.
  17. Side and Rear Wall Panels: Satin stainless steel, No. 4 finish.
  18. Ceiling: Satin stainless steel, No. 4 finish.
  19. Flooring: Finished flooring as selected by Architect.
  20. Handrails: Satin stainless steel, No. 4 finish, at sides and rear of car.
  21. Miscellaneous Items:
    - a. Disabled Access Requirements
    - b. Key Operated Hoistway Access
    - c. Earthquake Requirements
    - d. Oil Cooler
- B. Passenger Elevator #2, Bldg 5N:
1. Type: Holed, hydraulic, under-the-car single cylinder
  2. Capacity: 3500 Pounds
  3. Speed: 125 FPM
  4. Stops: 3
  5. Openings: 3 in line
  6. Travel: As Shown
  7. Control: MotionControl Engineering or equivalent
  8. Operation: Duplex Selective Collective
  9. Machine Location: Location: Adjacent, 1st Floor
  10. Special Operations:
    - a. Independent Service
    - b. Fire Emergency Service
    - c. Emergency Battery Lowering
  11. Car Enclosure Type: Passenger
    - a. Platform Size: 7' - 0" W by 6' - 2" D by 9' - 0" H
    - b. Inside Clear: 6' - 8" W by 5' - 4" D by 7' - 11" H
  12. Signals and Fixtures Design as Specified
    - a. Car Operating Panels 1 Per Car
    - b. Car Position Indicator Integral with Car Panel
    - c. Communication Sys.: Integral with Car Panel
    - d. Service Cabinet: Integral with Car Panel
    - e. Hall Pushbuttons: 1 Riser
    - f. Hall Lanterns: All Floors
  13. Passenger Entrance Type Center Open, Single Speed
    - a. Size: 3' - 6" W by 7' - 0" H
    - b. Frames
      - 1) Main Floor: Stainless Steel
      - 2) Typical Floors: Stainless Steel

14. Doors
  - a. Main Floor: Stainless Steel
  - b. Typical Floors: Stainless Steel
15. Sills
  - a. Main Floor: Nickel silver, polished
  - b. Typical Floors: Nickel silver, polished
16. Cab: Steel shell.
17. Side and Rear Wall Panels: Satin stainless steel, No. 4 finish.
18. Ceiling: Satin stainless steel, No. 4 finish.
19. Floor: Finished flooring as selected by Architect.
20. Handrails: Stainless steel, No. 4 finish, at sides and rear of car.
21. Miscellaneous Items:
  - a. Disabled Access Requirements
  - b. Key Operated Hoistway Access
  - c. Earthquake Requirements
  - d. Card Reader Provisions
  - e. Oil Cooler

C. Passenger Elevator #3, Bldg 5N:

1. Type: Holed, hydraulic, under-the-car single cylinder
2. Capacity: 3500 Pounds
3. Speed: 125 FPM
4. Stops: 2
5. Openings: 2 in line
6. Travel: As Shown
7. Control: MotionControl Engineering or equivalent
8. Operation: Duplex Selective Collective
9. Machine Location: Location: Adjacent, 1st Floor
10. Special Operations:
  - a. Independent Service
  - b. Fire Emergency Service
  - c. Emergency Battery Lowering
11. Car Enclosure Type: Passenger
  - a. Platform Size: 7' - 0" W by 6' - 2" D by 9' - 0" H
  - b. Inside Clear: 6' - 8" W by 5' - 4" D by 7' - 11" H
12. Signals and Fixtures Design as Specified
  - a. Car Operating Panels: 1 Per Car
  - b. Car Position Indicator: Integral with Car Panel
  - c. Communication Sys.: Integral with Car Panel
  - d. Service Cabinet: Integral with Car Panel
  - e. Hall Pushbuttons: 1 Riser
  - f. Hall Lanterns: All Floors

13. Passenger Entrance Type Center Open, Single Speed
  - a. Size: 3' - 6" W by 7' - 0" H
  - b. Frames
    - 1) Main Floor: Stainless Steel
    - 2) Typical Floors: Stainless Steel
14. Doors
  - a. Main Floor: Stainless Steel
  - b. Typical Floors: Stainless Steel
15. Sills
  - a. Main Floor: Nickel silver, polished
  - b. Typical Floors: Nickel silver, polished
16. Cab: Steel shell.
17. Side and Rear Wall Panels: Satin stainless steel, No. 4 finish.
18. Ceiling: Satin stainless steel, No. 4 finish.
19. Floor: Finished flooring as selected by Architect.
20. Handrails: Stainless steel, No. 4 finish, at sides and rear of car.
21. Miscellaneous Items:
  - a. Disabled Access Requirements
  - b. Key Operated Hoistway Access
  - c. Earthquake Requirements
  - d. Oil Cooler

## 2.5 FINISHES

- A. Exposed-to-View Surfaces. Provide as follows unless otherwise specified.
  1. Aluminum: Clear anodized finish.
  2. Sheet Steel:
    - a. Shop Prime: Degrease clean of foreign substances and apply one coat of corrosion inhibiting primer compatible with finish paint selected. Hoistway items visible to public shall be painted one additional coat of black paint.
    - b. Finish Paint: Factory applied baked enamel or powder coat; color as selected.
  3. Stainless Steel:
    - a. Plain: Satin, directional polish, No. 4 finish unless otherwise specified.
    - b. Patterned: Rigidized Metal's No. 5 WL, RIMEX Metals No. 5-SM or equal.
  4. Touch-Up:
    - a. Prime Surfaces: Use same paint as factory for field touch-up.
    - b. Finish Painted Surfaces: Refinish whole panel with shop prime and finish paint as specified above.
- B. Non-Exposed-to-View Surfaces: Degrease and shop paint manufacturer's standard corrosion inhibiting primer.
- C. Galvanizing:
  1. Sheet Steel: ASTM A446, or A526, as applicable. Coating designation G185.

2. Other Galvanizing: ASTM A123, ASTM A153, ASTM 385 or ASTM 386, as applicable.
  3. Galvanizing Touch Up: Zinc dust coating, MIL-P-21035 or MIL-P-26915.
- D. Paint and Corrosion Protection: Equipment shall have the following minimum corrosion protection:
1. All steel parts shall be sandblasted in accordance with SSPC and painted with a rust inhibiting primer coat.
  2. Steel parts which are not specified to be galvanized shall be painted with a 1) first finish of two (2) mil dry film thickness and 2) a second finish coat of two (2) mil dry film thickness

## 2.6 AUTOMATIC OPERATION

- A. General Operation of Individual Elevators:
1. Provide a non-proprietary microprocessor-controlled dispatching system designed to monitor all types of traffic and sufficiently flexible so that it can be modified to accommodate changes in traffic patterns. Include hardware necessary to protect hoist motors, motor drives and door operators. Software shall control group and simplex program operations.
  2. Pre-Approved Products:
    - a. Motion Control Engineering HMC-2000
  3. The system shall continuously monitor the demand based on real time calculations to assign and reassign the elevators to handle the traffic in the most efficient manner.
- B. Simplex Selective Collective Operation:
1. Provide a microprocessor-based control system to perform functions of elevator motion, car operation dispatching and door control.
  2. Arrange for Simplex Selective Collective automatic operation. Operate elevators from a single riser of landing buttons and from operating device in car.
  3. Momentary pressure of one or more car or landing buttons, other than those for landing at which car is standing, starts car, and causes car to stop at first landing for which a car or landing call is registered corresponding to direction in which car is traveling. Stops made in order in which landings are reached, irrespective of sequence in which calls are registered.
  4. Double door operation not permitted. If an up traveling car has a passenger for an intermediate floor and a down call is registered at that floor, with no calls above car, it travels to floor, opens door to let passenger out, then lights down direction arrow in hall lantern and accepts waiting passenger without closing and reopening doors.
- C. Two-Stop Collective Operation:
1. Provide a microprocessor-based control system to perform functions of elevator motion, car operation dispatching and door control.
  2. Operate elevator from single button landing stations and operating buttons in car.
  3. Landing or car button causes car to start and proceed to that floor. Doors open automatically when car arrives. When car is traveling away from a registered landing call, call remains registered and car responds on next trip.

## 2.7 SPECIAL OPERATIONS

- A. Inspection Operation: Provide key-operated hoistway access device and car top operating device. Key switches shall be mounted in doorframes with only ferrule exposed at terminal landings. Incorporate access switches in hall button stations for freight elevators.
- B. Independent Service: Independent service operation shall be provided so that, by means of a switch located in the car service cabinet, the car can be removed from automatic operation and be operated by an attendant. The attendant shall have full control of the starting, stopping and direction of car travel. The car shall respond to car buttons only. The hall signals for the car on independent service shall not operate.
- C. Operation Under Fire or Other Emergency Conditions: Provide special emergency service to comply with ASME A17.1, CCR Title 8, UBC and local codes having jurisdiction. Provide Phase 1 recall switch at Main Floor Elevator Lobby. Interlock recall switches to prevent simultaneous activation. Key switches at main floor shall be integrated in hall button station with engraved instructions.

## 2.8 DOOR OPERATION

- A. Passenger Type Horizontal Sliding:
  - 1. Door Operator: Provide heavy-duty master type operators with direct current motor. Provide closed-loop door operator GAL-MOVFR.
    - a. Provide door times available as specified under "Design Criteria".
    - b. Car and hoistway doors shall open and close simultaneously, quietly and smoothly; door movement shall be cushioned at both limits of travel. Door operation shall not cause cars to move appreciably.
    - c. Door hold open times shall be readily and independently adjustable when car stops for a car or hall call. Main floor door hold times shall be adjustable independent of other floors.
  - 2. Hangers and Tracks: Sheave type with two-point suspension. Steel sheaves with flanged groove and resilient sound-absorbing tires. Minimum 2-1/2 inch diameter for hoistway, 3 inch for car. Manufacturer's heavy-duty tracks and ball or roller bearing with adjustable up thrusts.
- B. Door Protection; Passenger Type:
  - 1. Electronic Scanning Type:
    - a. Provide a door protective system, which does not rely on physical contact with a person or object to inhibit door movement or initiate door reversal. Provide system equal to the Otis "Lambda II", Adams "I.C.U.", CEDES or Janus "Panaforty".
    - b. The system shall be able to detect a 2-inch diameter rod introduced at any position within the door movement and between the height of 2 inches and 63 inches above sill level.
    - c. Detection of intrusion into the protected area shall cause the doors, if fully open, to be held in the open position and, if closing, to reverse to fully open position.
    - d. If doors are prevented from closing for an adjustable period of 15 to 45 seconds or upon activation of Fire Emergency Service, they shall proceed to close at reduced speed and a loud buzzer shall sound. Door closing force shall not exceed 2-1/2 ft.-lbs. when door re-opening device is not in operation.

- e. For side-opening doors, the detector for the strike jamb side shall be recessed, flush with strike jamb.

## 2.9 SIGNALS AND OPERATING FIXTURES

- A. General: Provide signals and fixtures as shown and specified. Location and arrangement of fixtures shall comply with handicap requirements.
  - 1. Passenger Elevator Buttons: Provide minimum 1-inch diameter mechanical, white illuminated buttons raised 1/8 inch from surrounding surface with square shoulders and with engraved identifications. Operation of car or hall button shall cause button to illuminate. Response of car to car or hall call shall cause corresponding button to extinguish.
  - 2. Switches: Toggle type typically or key operated where noted.
  - 3. Faceplates: Provide of material and finish as indicated and specified; 1/8 inch minimum thickness with sharp edges relieved. Unless otherwise specified provide stainless faceplates for passenger cars and stainless steel faceplates for service cars.
  - 4. Fastenings: Provide with concealed fasteners for passenger cars and with flush tamper-proof screws of material and finish matching faceplates for service and freight elevators.
  - 5. Cabinets: Provide with pulls, concealed hinges and doors mounted flush with hairline joints to adjacent surface.
  - 6. Arrangement: Arrangement of fixtures shall generally conform to that specified, but components may be rearranged, if desired, subject to Owner's Representative's approval.
  - 7. Engraving: Of size indicated; color backfill with epoxy paint in contrasting color as selected.
  - 8. Lamps: Miniature LED type.
  - 9. Audible Chimes: Electronic adjustable audible chimes; bell type gong not acceptable.
  - 10. Provide floor passing signal of the adjustable electronic audible chime type.
  - 11. Tactile Markings: Provide raised Braille and alpha characters, numerals or symbols to the left of operating buttons and devices used by the public. Indications may be engraved directly on faceplates or separate plates flush mounted with hairline joints and concealed mechanical fasteners. Plates shall be of same size and shape as buttons. Raised characters shall be white on a black background with Braille designation directly below the character.
- B. Car Operating Panels:
  - 1. General: Provide buttons numbered to conform to floors served and the following:
    - a. Locate top operating button at 48 inches above floor; maximum 54 inches when required.
    - b. Locate emergency stop and illuminated alarm button in bottom row at 35 inches above floor. Wire emergency stop to ring alarm bell.
    - c. Provide "Door Open" and "Door Close" buttons located above emergency stop and alarm of same design as car button.
    - d. Engrave main panel with capacity, number of passengers and elevator number in 1/4-inch letters. Engrave auxiliary panel with NO SMOKING in 1-inch letters. All other signage required by local codes shall be engraved as directed by Owner's representative.
    - e. Provide fire emergency key switch, engraved instructions and call cancel button with audible/visual signals.

2. Car Control Stations: Provide car control stations mounted on rear of return panel adjacent to car door and with buttons, switches, controls, and indicator lights projecting through return panel but substantially flush with face of return panel.
  - a. Mark buttons and switches with standard identification for required use or function that complies with ASME A17.1. Use both tactile symbols and Braille.
- C. Car Position Indicators: Provide car position indicators with indications corresponding to floor designations with matching direction arrows and floor passing chimes. Provide digital type direct readout indicator with minimum one-inch high indications mounted integral with each car-operating panel.
- D. Service Cabinet: Provide cabinet door with a lock and concealed hinge as an integral part of car operating panel mounted with flush hairline joints. Cabinet door shall be provided with a flush glazed window of required size to hold elevator-operating permit. Service cabinet shall contain the following:
  1. Independent service switch.
  2. Two-speed ventilation switch.
  3. Light switch or dimmer as applicable.
  4. Inspection switch, key operated.
  5. Duplex convenience outlet.
  6. Buzzers as required.
  7. Constant pressure test switch for emergency car lighting.
- E. Speaker Phone: Provide a complete communication system in compliance with A.D.A. regulations consisting of a combination speaker/microphone, amplifier, and automatic dialer with 4 number rollover capability and matching car station push button with telephone symbol to activate system and call-acknowledgement lights. Mount behind a pattern of holes as selected as an integral part of car operating panel. Wire to machine room and program automatic dialer as directed by Owner.
- F. Hall Button Fixtures: Each fixture shall contain buttons, which light to indicate hall call registration and extinguish when call is answered. Engrave fire-exiting instructions on faceplates.
- G. Hall Lanterns: Provide with single chime for up and double chime for down direction. Lantern illuminates white for up and red for down. As car approaches floor, lantern shall illuminate and chime approximately 4 seconds prior to doors opening to indicate next direction of travel. Provide manufacturer's standard plug-in type hall lanterns with triangular lenses with faceplates.

## 2.10 WIRING

- A. General: Provide all necessary wiring with 15 percent or a minimum of four spares between cars and controllers and to all remote control stations. Furnish shielded wires in cables for all communications card readers and speakers. Include two additional pairs of shielded spares for each car.
- B. Traveling Cables: Use minimum number of traveling cables with flame retarding and moisture resisting covers. Include shielded wires and spares as noted above. Cord thoroughly and protect cables from rubbing against hoistways or car items. Provide with steel cable core and properly anchored to relieve strain on individual conductors.

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- C. Work Light and Convenience Outlet: Provide on top of car with wire lamp guard.
- D. Stop Switch: Provide in each pit and on top of car.
- E. Alarm Gong: Six-inch size, 110 volt. Provide on top of each car and one per group inside of hoistway at main landing to be actuated by corresponding alarm button or emergency stop switch.
- F. Auxiliary Disconnect Switches: Provide as required in remote controller rooms or at remote equipment not in view of mainline switches; include all wiring and conduit.

## 2.11 CAR ENCLOSURES

- A. General: Fabricate finish work smooth and free from warps, buckles, squeaks and rattles; joints lightproof. Car shall be sound isolated from car frame. Apply outside of car with 3/16-inch thick sound deadener. No visible fastenings, except as indicated.
- B. Passenger Cars; Elevator No. (Passenger Elevators only): Provide passenger car enclosures as described below with final interior design and finishes as indicated on Architectural Drawings and below.
  - 1. Steel Shell: Fabricate walls of 16-gauge sheet steel from floor to canopy. Canopy 14 gauge reinforced. Paint shell in color as selected by Owner's Representative.
  - 2. Emergency Exit: Top of car per code.
  - 3. Ventilation: Two-speed squirrel cage exhaust blower, Man-D-Tec MVS-12 or equal with sound isolation mounting on canopy. Provide concealed vents above base or ceiling as designed.
  - 4. Car Doors: Fabricate from 16-gauge sheet steel on front and back of each panel sufficiently reinforced with steel to insure rigidity and sound deadened. Provide two guides per panel located one inch from each end. Provide full-length neoprene astragals. Finish car side with stainless steel and return finish 1/2 inch around edge of doors.
  - 5. Protective Pads: Provide one set of heavy quilted protection pads for each group of elevators. Total two sets of pads required. Pads shall cover all walls with cut-out sections for car operating panels.
  - 6. Front Return Panels: Provide full integral swing type front return panels fabricated from 14 gauge stainless steel.
  - 7. Interior Panels, Ceiling, Lighting, Handrail, and Special Trim covered under dollar allowance. Assume car interior finishes will not exceed 2,000 pounds.
  - 8. Sills: Nickel silver, threshold plate. Mount with concealed mechanical fasteners. Allow for installation of finish flooring.
  - 9. Finish Flooring: As indicated on Drawings.

## 2.12 HOISTWAY ENTRANCES; PASSENGER TYPE

- A. General: Fabricate finish work smooth with flush surfaces and free from warps and buckles. Entrance assemblies shall bear 1-1/2 hour U.L. rating. Provide entrances of size and type as scheduled.
- B. Struts and Closer Angles: As required for entrance installation and door closer mechanism. Use full-length struts. Hanger headers, minimum 3/16 inch material extending from strut to strut.



- C. Dust and Hanger Covers: Provide as required of minimum 16-gauge sheet steel. Provide hanger cover plates extending full length of door track. Paint black.
- D. Fascia, Toe and Head Guards: Minimum 16 gauge sheet steel; reinforce fascia. Paint black. Provide blind fascia in express zones or for reverse openings as required.
- E. Sills: Extruded sills with non-slip surfaces and grooves suitable for guides. Extend strut to strut and mount without exposed screws. Provide all support angles and levelers for a complete installation. Sill material as scheduled.
- F. Frames: Fabricate from 14-gauge material with side jambs in one continuous piece from sill to head section. Head and jamb bolted to provide unit frames with neat appearance from corridor side. Material and finish of frames as scheduled.
- G. Doors: Fabricate from 16-gauge material sufficiently reinforced with steel to insure rigidity and sound deadened. Provide two guides per panel, which will remain engaged in sill if guiding member is destroyed. Provide full-length neoprene astragals on leading edge and non-vision wings of material and finish to match doors. There shall be no keyholes in the door unless required by governing authority. Corridor side of door panel material and finish as scheduled. Return finish a minimum of 1/2 inch around edges of door.
- H. Tactile Markings: Provide raised Braille and alpha characters, numerals or symbols similar to those for car stations of size required by governing authority. Locate on each entrance jamb at 60 inches above floor indicating floor designation. Material and finish of plates shall have contrasting background and mounting means similar to those on car panels.

### 2.13 HYDRAULIC ELEVATOR EQUIPMENT

- A. Design Criteria:
  - 1. Performance:
    - a. Contract Speed: Maximum twenty percent (20%) speed variation under any loading condition in either direction.
    - b. Motion Time: From start to stop of elevators motion as measured in both directions for a typical one floor run under any loading condition. Initiate movement of car within 1.5 second after make-up of hoistway door interlock.
      - 1) 125 FPM: 9.1 seconds
    - c. Door Close Times: Minimum, without exceeding kinetic energy and closing force, allowed by code.
    - d. Door Dwell Times: Comply with A.D.A. formula and provide separate adjustable timers with initial settings as follows:
      - 1) Main Lobby Hall Call: 5.0 seconds.
      - 2) Upper Lobby Hall Call: 5.0 seconds.
      - 3) Car Call: 5.0 seconds.
      - 4) Interruption of Door Protective Device: Reduce dwell to 1 second after all ADA requirements have been met.
    - e. Leveling: Within 3/8 inch under any loading condition. Level into floor at all times, do not overrun floor and level back.
    - f. Hydraulic Pressure: Hydraulic components shall be factory tested for 600 PSI. Maximum operating pressure shall be 425 PSI.

### HYDRAULIC ELEVATORS

2. Operating Qualities: Owner's representative will judge riding qualities of cars and enforce the following requirements. Make all necessary adjustments.
    - a. Starting and stopping shall be smooth and comfortable. Slowdown, stopping and leveling shall be without jars or bumps.
      - 1) Vertical Acceleration: Maximum 4 ft. per second squared. Maximum jerk 8 ft. per second cubed.
      - 2) Horizontal Acceleration: Maximum 10 mg peak-to-peak measured at full speed for full travel in both directions.
    - b. Full Speed Riding: Free from vibration and sway.
  3. Sound Control:
    - a. Vibration: Sound isolate the power units from building structure to prevent objectionable noise and vibration transmission to occupied building spaces.
    - b. Airborne Noise: Maximum acoustical output level of:
      - 1) 85 dba measured in machine room.
      - 2) 60 dba measured in elevator cars during all sequences of operation.
      - 3) 50 dba measured in elevator lobbies.
- B. Buffers: Spring type mounted on cylinder support channels with required blocking and supports.
- C. Car Frame and Platform:
1. Passenger Elevators: Manufacturer's standard steel members, steel frame with steel or double wood floor.
- D. Platen Isolation: Provide minimum 3/4-inch thick steel plates between top of plunger and car frame with one inch rubber or neoprene isolation material between.
- E. Cylinder Well and Casing:
1. Well: The Elevator Installer shall familiarize himself with existing conditions and be responsible for drilling cylinder wells.
  2. Casing: Provide steel or Schedule 40 PVC outer casing, 12 inches greater in diameter than wrapped cylinder and proper depth to retain hole and provide structural integrity of PVC casing. Provide well casing having watertight joints and closed bottom. Weld seams solid at multiple casing joints. Provide a steel ring at top of casing to be keyed into pit floor. Provide watertight seal at bottom using 2 feet 0 inches thick non-shrink concrete plug of type for installation under water where drive casing is required and closed bottom casing cannot be installed.
  3. Provide minimum 3/8 inch thick PVC casing with watertight sealed couplings and bottom end caps. Inside diameter shall be 6 inches greater than outside diameter of cylinder. Extend PVC above pit floor. Seal top of PVC and provide an inspection port of 2-inch diameter by 4-inch long PVC pipe with threaded cap.
  4. Installation: Set cylinder and PVC casing within steel or PVC outer casing. Backfill between hole and outer casing with natural soils the full height of hole. Plunger and cylinder shall be plumb within 1/16 inch.
- F. Cylinder: Steel pipe, factory tested for 600-pounds/square inch working pressure. Sandblast or wire brush outside of cylinder to remove rust and scale. Paint with heavy coat of epoxy or mastic. Work shall be done in shop and repaired in field if coating is damaged.

- G. Plunger: Use seamless steel pipe or tubing, minimum Schedule 80. Plunger shall be no more than 0.010 inch out of round and straight within 1/16 inch. Protect during shipping and installation to avoid damage. If plunger is gouged, scarred or shows visible tool marks, it shall be replaced. Finish shall be 20 micro inches or finer. Plunger top shall be isolated from car frame. Plungers with follower guides are not acceptable.
- H. Packing: Provide packing, which inhibits leaking of oil with drip ring.
- I. Piping: Minimum Schedule 80 steel pipe suitable for 600 pounds pressure. No hoses shall be used in any part of piping. Provide sound isolating couplings in oil line between jack and pumping plant. Support piping using vibration isolating mounts or hangers with integral felt or neoprene at least 1/4 inch thick. Use threaded or welded joints throughout except at the connections to power unit and cylinder unit. Use no more than two victaulic type connections in the machine room and two in the pit area.
1. Overhead and Exposed Piping: Provide drip deflectors at pipe joints where pipes run above ceiling areas to prevent damage to these areas in case of joint leakage.
  2. Underground Piping: Protect with extruded high density polyethylene coating having a thickness of 25 to 60 mills applied with a minimum 8 mill thickness of modified rubber adhesive material all as manufactured by Plexco or equal. Install piping on three-inch bed of clean, dry sand and backfill with additional three inches of sand.
  3. Testing: Before enclosing pipe system, close ends, fill with fluid, establish 600 PSI pressure and allow to stand for 24 hours. Make corrective repairs to leaks or pressure drop.
- J. Pit Valves:
1. Provide in each elevator pit a gate valve to shut off oil between cylinder and pumping plant.
  2. Provide a pressure type line rupture safety valve to shut off oil between cylinder head and pit valve. Activation of safety valve shall not void operation of lowering valve.
- K. Pumping Plant:
1. General: Self-contained unit with sound reducing cabinet and sound isolated base.
  2. Pump: IMO, Roper or accepted equal for 150 SSU oil, belt driven or submersible. Maximum speed 3600 RPM. Maximum pressure 425 pounds per square inch.
  3. Tank: Capacity equal to plunger displacement plus 10%. Provide strainers, oil level sight gauge and device to maintain uniform oil temperature.
  4. Valves: Integral type by Elevator Equipment Company, Maxton Company or by elevator manufacturer. Provide conveniently located manual lowering valve accessible without removing pumping plant enclosure panels.
  5. Motor: General Electric, Imperial, Westinghouse or accepted equal; maximum speed 1800 RPM for belt driven and 3600 RPM for submersible. Provide minimum 80 start heavy-duty motor, continuous rated, 50 degrees C. temperature rise, Class A insulation or 70 degrees C. rise for Class B insulation.
  6. Controller: Integral, floor or wall mounted as applicable to space conditions. Include door-operating relays combined with controller. Provide SCR solid-state soft start starting. Provide three (3) manual reset overload relays, one in each line and reverse phase relay. Provide externally mounted permanently identified junction boxes on controller cabinets for termination of communication circuits.
  7. Muffler: Blowout proof type between pumping plant and cylinder.

- L. Oil Cooling System: Provide manufacturers standard oil cooler designed for hydraulic elevator use.
- M. Hydraulic Elevator Protective Circuit: In the event the car should stall due to low oil in the system or, if for other cause the car fails to reach the top landing within a predetermined time while traveling "up", a special circuit shall be provided which shall automatically return the car to the bottom landing and open the doors for 10 seconds after which the elevator will close doors and completely shut down. Recycling the mainline switch shall restore Service.
- N. Hydraulic Elevator Battery Emergency Lowering Operation: Provide a battery driven unit which will initiate operation of the Protective Circuit and lower elevator to bottom landing in the event of a power failure. Service shall be restored automatically upon restoration of normal power supply. Arrange with an exposed method of testing. Arrange circuitry so that, if the mainline switch is open when the power transfer takes place, the elevator will not respond to the operation of the protective circuit. Provide a double pole-isolating switch on the battery unit to disconnect the battery output.

## **PART 3 - EXECUTION**

### **3.1 GENERAL**

- A. Bidding Documents: Bidders shall examine architectural, structural, electrical and mechanical plans and specifications. Any discrepancies which affect the elevator work or conditions adverse to the bidder's equipment shall be brought to Owner's Representative's attention at least seven (7) days prior to the bid date. If no discrepancies are presented, changes required to accommodate bidder's equipment become the responsibility and cost of the Elevator Contractor.

### **3.2 PREPARATION**

- A. Field Measurements: Field-verify dimensions before proceeding with the work. Coordinate related work by other trades. Verify the following to be acceptable for installation of elevators.
  1. Hoistway has been correctly sized and otherwise properly prepared.
  2. Equipment supports are satisfactory.
  3. Electrical rough-ins are correct.
  4. Do not begin installation until unsatisfactory conditions have been corrected.

### **3.3 INSTALLATION**

- A. General: Install per manufacturer's requirements, those of regulatory agencies and as specified.
- B. Welded Construction: Provide welded connections for installation of elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustments, inspection, maintenance and replacement of worn parts. Comply with AWS standards for workmanship and for qualifications of welding operators.

- C. Sound Isolation: Mount rotating and vibrating elevator equipment and components on vibration-absorption mounts, designed to effectively prevent transmission of vibrations to structure and thereby, eliminate sources of structure-borne noise from elevator system.
- D. Lubricate operating parts of systems, including ropes, as recommended by manufacturer.
- E. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails, for accurate alignment of entrances with cars. Where possible, delay final adjustment of sills and doors until car is operable in shaft. Reduce clearances to minimum, safe workable dimensions at each landing.
- F. Erect guide rails plumb and parallel with maximum deviation of 1/16 inch. Anchorage of guide rails shall not compromise waterproofing. Do not bottom rails on pit floor.
- G. Graphics: Provide graphics visible to public as selected by Owner's Representative.
- H. Manufacturer's Nameplates: Manufacturer's nameplates, trademarks or logos not permitted on surfaces visible to public.

### **3.4 TEMPORARY ELEVATOR USE DURING CONSTRUCTION**

- A. General: Should the General Contractor require the use of any elevator during construction, Contractor shall make arrangements directly with the Elevator Contractor, coordinate temporary facilities and pay all costs associated with the protection, operation and use of elevators.
- B. Maintenance: Elevators shall be maintained on a regular basis during the temporary construction use. A minimum of two hours per week per elevator shall be spent on examination, lubrication, adjusting and cleaning the elevator equipment.
- C. Damage: The Owner is entitled to receive new elevator equipment upon final acceptance of the entire project. The Owner's representative will thoroughly examine all elevator equipment upon completion of temporary use and provide a punch-list outlining items that must be repaired or replaced to ensure the equipment is in new condition. Final acceptance and payment will not be made until all items have been satisfactorily completed.
- D. Schedule: Sufficient time must be allowed to prepare and adjust temporary elevators so that the entire elevator installation is ready for final acceptance.

### **3.5 TEMPORARY ACCEPTANCE AND USE BY OWNER:**

- A. When an elevator is near completion and declared ready for service, before completion of other elevators, Owner agrees to accept elevator and place it into automatic service.
- B. The elevator must be tested and inspected by regulatory agencies and a permit to operate issued.
- C. A walk-through examination will be performed in the presence of Owner's Representative, General Contractor and Elevator Contractor to determine present condition of elevator.
- D. The Owner agrees to sign or cause the General Contractor to sign a temporary acceptance form that is mutually agreeable to all parties.

## **HYDRAULIC ELEVATORS**

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- E. During this temporary acceptance period, the Owner agrees to pay or cause the General Contractor to pay an agreed amount per day per elevator for regular maintenance. The cost for this maintenance per elevator, per day, shall be stated in the Elevator Contractor's bid.
- F. The guarantee and full maintenance period will be effective upon final acceptance of the entire installation.

### **3.6 FIELD QUALITY CONTROL**

- A. Regulatory Agencies Inspection: Upon completion of elevators, Contractor shall provide instruments, weights and personnel to conduct test required by regulatory agencies. The Contractor shall submit a complete report describing the results of the tests.
- B. Examination and Testing: When installation is ready for final acceptance, notify and assist Owner's Representative in making a walk-through review of entire installation to assure workmanship and equipment complies with contract documents. Provide equipment to perform the following tests:
  1. One-hour heat and run test with full load in car. Perform for one car of each duty.
    - a. Stop car at each floor in each direction.
    - b. Provide well-shielded thermometers for motor and verify that temperatures do not exceed 50 degrees Centigrade above ambient.
    - c. Performance and leveling tests shall be made before and after heat and run test.
  2. Check and verify operation of all safety features and special operations.
    - a. Measure horizontal acceleration.
    - b. Measure acoustical output levels in machine room, lobbies and cars.
- C. Correction: Make corrections to defects or discrepancies at no cost to Owner. Should discrepancies be such that re-examination and retesting is required, the Elevator Contractor shall pay for all costs including those of Owner's representative fees.
- D. Final Acceptance: Final acceptance of the installation will be made only after all corrections are complete, final submittals and certificates received and the Owner is satisfied and the installation is complete in all respects. Final payment will not be made until the above is completed.

### **3.7 INSTRUCTIONS**

- A. Instruct Owner's personnel in proper use of each system.

### **3.8 MAINTENANCE**

- A. General: Provide complete continuing maintenance on entire elevator equipment during regular working hours on regular working days for a period of 12 months after filing Notice of Completion.
- B. Examination: Include systematic examination, adjustment, and lubrication of elevator equipment whenever required and replacement of defective parts with parts of same manufacture as required for proper operation. Contractor not responsible for repairs to car enclosures, door panels, frames, sills or platform flooring resulting from normal usage or misuse, accidents and negligence for which Contractor is not responsible. Examinations shall

be performed monthly expending a minimum of one hour per unit per visit performing preventative maintenance service.

C. Performance Standards:

1. Maintain the performance standard set forth in this Specification and maintain correct operation of the dispatching system.
2. Maintain smooth starting and stopping, smooth riding qualities and accurate leveling at all times.

D. Callbacks: In event of failures, provide 24-hour callback service at no additional cost to Owner.

E. Elevator Shutdowns:

1. Should any elevator become inoperative, repair within 24 hours of notification of such failure. Breakdown of major components shall be completed and service restored within 72 hours.
2. Failure to comply with above, Owner may order the work done by other contractors at the Contractor's expense.
3. Devices repaired or replaced by others shall, nevertheless, be provided with maintenance by the Contractor who shall become completely responsible for correct operation of such devices for lifetime of this contract.

F. Follow-Up Tests: Test all safety devices and emergency operations at six (6) month intervals or oftener and submit written report on each test. Make tests at times which do not interfere with building operation.

G. Maintenance Materials:

1. Replacement Parts: Keep the following parts in a warehouse within 50 miles of the project premises.
  - a. One door operator motor of each type used.
  - b. Transformers of each type installed.
  - c. Two complete door interlocks.
  - d. Parts for door protective devices.
  - e. One set of packing for each size cylinder.
  - f. Such other parts as are needed to insure prompt replacement in event of elevator shutdown such as spare control boards for computer-operated systems.
2. Expendable Parts: The Elevator Contractor shall provide a metal cabinet in at least one machine room on project premises containing the following expendable parts required for prompt replacement. Parts used for routine maintenance shall be replenished and stored in machine room to ensure an adequate supply is available. Parts and cabinet shall become Owner's property and not removed upon expiration of maintenance period.

H. Maintenance Data: After completion and prior to final acceptance, submit three sets of complete and accurate maintenance data specific for each elevator. Final payment will not be made until received.

1. Manuals: Describe proper use and maintenance of equipment, lubrication points, and types of lubricants used and frequency of lubricant application.
2. Parts Catalogs: Complete listing of all parts of equipment and components used in the installation.

3. Wiring Diagrams: One laminated set mounted in machine room, one reproducible mylar set and one blue line set delivered to Owner. Wiring diagrams shall be as built, specific for this installation, and reference identification on drawings shall match points identified on terminals of controllers.
  4. Maintenance Tool and Software Manuals: Provide maintenance tools and supporting software documentation required for the complete maintenance of the entire system including diagnostics and adjusting. Maintenance tool may be hand held or built into control system and shall be of the type not requiring recharging or reprogramming nor of the automatic destruct type. The tool and supporting software may be programmed to operate only with this project's identification serial numbering.
- I. Final Service and Inspection: Two weeks before expiration of the year's maintenance, the equipment shall be lubricated, fully serviced, adjusted to the standards designated and emergency service operation devices shall be checked. A representative of the Owner will make a complete inspection.
  - J. Quotation: Base bid shall include cost of maintenance and materials as described above.

**- END OF SECTION -**





## **DIVISION 21 – FIRE SUPPRESSION**

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**- SECTION 21 1313 -**

**WET PIPE SPRINKLER SYSTEMS**

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**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. Design and install a complete hydraulically calculated fire sprinkler system to meet or exceed the requirements of NFPA 13, NFPA 14, and the Authority Having Jurisdiction. Items required for this work include, but are not limited to, the following:
  - 1. Hydraulically calculated automatic fire sprinkler system.
  - 2. Preparation of complete Shop Drawings.
  - 3. Required permits, licenses and inspections.
  - 4. Testing.
  - 5. Project record documents.

**1.3 SUBMITTALS**

- A. Shop Drawings and Manufacturer's Data:
  - 1. Submit a complete a set of shop drawings wet stamped and signed by a fire protection engineer registered in the State of California.
  - 2. Submit a complete and detailed material list of items to be furnished and installed under this section.
  - 3. Submit manufacturer's specifications and other data required to demonstrate compliance with the specified requirements.
- B. Record Drawings:
  - 1. At completion of installation, project record drawings of installed work shall be delivered to the Architect.

**1.4 QUALITY ASSURANCE**

- A. Qualifications of the Contractor:
  - 1. Contractor shall have a current C-16 license in the State of California and shall be experienced in the installation of engineered fire sprinkler systems.

- B. Qualifications of the Manufacturer:
  - 1. Products used in work of this section shall be produced by manufacturers regularly engaged in manufacture of similar items and with a 5 year history of successful production.
- C. The design, installation, and testing of this fire sprinkler system shall be in accordance with NFPA 13, NFPA 14, local codes and the Authority Having Jurisdiction.

## 1.5 DESIGN CRITERIA

- A. Piping and sprinkler head arrangement shall take into consideration the architectural and structural layout of the building and shall follow the guidelines of NFPA 13.
- B. Occupancy Classifications shall be in accordance with NFPA 13.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Pipe: Allied, Wheatland, Mac, Bullmoose, or equal.
- B. Fittings: Anvilstar, Ward, Tyco, Victaulic, or equal.
- C. Sprinkler Heads: Tyco, Viking, or equal.
- D. Valves: Tyco, Nibco, FPPI, Viking, or equal.
- E. Fire Protection Equipment: Zurn, Elkhart, Potter Roemer, TestanDrain, or equal.
- F. Supervisory Switches: Potter Electric, System Sensor, Notifier, or equal.
- G. Alarm Bells: Potter Electric, System Sensor, Tyco, Notifier, or equal.
- H. Hangers, Bracing, and Supports: Tolco, Afcon, or equal.

### 2.2 MATERIALS

- A. Pipe:
  - 1. 1" through 2": black steel, Schedule 40, UL Listed, ASTM A-135, threaded or grooved.
  - 2. 1-1/2" through 8": black steel, Schedule 10, UL Listed, ASTM-A135, roll grooved only.
  - 3. Welding of pipe, fittings, and outlets shall be in accordance with NFPA 13.
- B. Fittings:
  - 1. Cast iron fittings: 175 psi rated, UL Listed, FM Approved.
  - 2. Ductile iron fittings: 300 psi rated, UL Listed, FM Approved.
- C. Sprinkler Heads:
  - 1. Quick response, glass bulb type, UL Listed, FM Approved.

## WET PIPE SPRINKLER SYSTEMS

2. Standard or Extended coverage; having a minimum K-factor of 5.6.
    - a. Sprinkler heads used for special applications (window protection, water curtains, etc...) are permitted to have a K-factor lower than 5.6.
  3. Location:
    - a. Areas with finished gypboard ceilings: with respect to lights and HVAC registers wherever possible.
    - b. Areas with finished suspended ceilings: center of 1' x 1' or 2' x 2' tiles, "quarter point" of 2' x 4' tile.
    - c. Areas with no ceiling: symmetrical wherever possible.
  4. Type:
    - a. Areas with finished gypboard or suspended ceilings: use chrome pendant with chrome semi-recessed style escutcheon. Temperature rating per NFPA.
    - b. Above ceilings or at areas with no ceilings: use brass upright. Temperature rating per NFPA.
- D. Valves:
1. Floor control valves: Butterfly or OS&Y type, UL Listed, with tamper switch.
  2. Fire Hose Valves: 2-1/2", UL Listed, with male hose thread outlet of appropriate size for local Fire Department, with cap and chain.
  3. Globe valves, ball valves, and 3-way valves: brass or bronze, UL Listed.
  4. Check valves: brass, bronze, or cast iron body, UL Listed.

### 2.3 STORAGE AND HANDLING

- A. Store products to prevent accidental damage or damage from the elements.
- B. An area acceptable for the proper storage of products shall be provided by the general contractor.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and conditions under which work of this section shall be performed. Correct conditions detrimental to proper and timely completion of work. Do not proceed until unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Ream pipe and tube ends. Remove all burrs. Bevel all plain end ferrous pipe ends.
- B. Remove scale and foreign matter, from inside and outside of pipes, before assembly.
- C. Provide piping connections to equipment with flanged or grooved connections.

### 3.3 INSTALLATION

- A. Before connection to the water supply, ensure that the underground portion of the system has been tested and flushed and that the test and flush was witnessed and approved by the Authority Having Jurisdiction.
- B. Each building with a sprinkler riser shall be furnished with an accessible control valve with flow switch and tamper switch. In buildings with multiple stories, each floor shall have a separate control valve with flow switch and tamper switch. Control valves shall be installed no higher than five feet from the finish floor and securely enclosed or secured with a chain and break-a-way lock.
- C. Sprinkler lines within the building shall be concealed within the structure wherever possible. Risers shall be installed in utility rooms, supply rooms or similar service areas whenever possible, and shall not obstruct access to, or maintenance of other equipment within the space. Mains and risers shall be located within the area protected by the sprinkler system unless otherwise approved by the Authorities Having Jurisdiction.
- D. Routing of piping in non-concealed exposed areas shall be subject to the Architect's approval.
- E. Install FDC's, check valves, shut-off valves, gauges, inspectors test and drain assemblies and flow indicators as per drawings. FDC must be installed so that it is unobstructed and accessible for the Fire Department's first response unit.
- F. FDC's and Fire Hose Valves shall have protective caps installed.
- G. Pipe through floors, wall, ceilings, and at sprinkler head locations, shall be furnished with required sleeves, and escutcheons and fire caulking where indicated and/or required by code.
- H. Sprinkler system shall be provided with complete drainage facilities. Drain discharge may discharge into a sewer, storm drain, sump pit, street gutter, landscape area, or other acceptable location.
- I. Upon completion of the work of this section, and before Substantial Completion, subject the entire sprinkler system to tests as required by NFPA 13 and furnish the Owner with a certificate of compliance as required.
- J. Fire sprinkler systems, piping hangers, seismic bracing, anchors and supports shall conform to all NFPA 13, CBC and all other applicable codes and the requirements of this specification.
- K. Tee branch outlets on fire sprinkler mains shall be by the use of a threaded cast or ductile iron tee fitting, a groove type tee fitting, or by the use of a weld-o-let welded on by a certified welder as required by NFPA. Mechanical tee fittings are to be used only when necessary and need approval on a case by case basis.

### 3.4 FIELD QUALITY CONTROL

- A. All work of this section shall be supervised and reviewed by the installing contractor to verify the accuracy and acceptability of the installation.

**3.5 PROTECTION AND CLEANING**

- A. Protection of this sprinkler system from damage due to welding, soldering, fire proofing, painting, paint overspray, sandblasting, pressure washing, etc... shall be the responsibility of the contractor performing said work.
- B. The cleaning of sprinkler heads is prohibited. Any sprinkler heads with paint, foam, fire proofing material, grease, sealants, or other foreign substances applied to them, either intentionally or unintentionally, shall be replaced.

**- END OF SECTION -**





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# - SECTION 22 4000 -

## PLUMBING SYSTEMS

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### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 DESCRIPTION OF WORK

- A. The Contractor shall furnish all labor, materials, testing, tools, equipment, services, and transportation necessary for the completion of all plumbing work as indicated on the drawings and specifications herein. Work includes, but not limited to the following:
1. Soil, waste, and vent piping system including sewage ejectors, sump pumps, sand traps, connections to equipment furnished in another section of work.
  2. Storm drainage piping system including roof drains, overflow drains, area drains.
  3. Indirect waste piping including connections to equipment furnished in another section of work.
  4. Condensate drain piping system including connections to equipment furnished in another section of work.
  5. Domestic hot, cold water piping systems including water heaters, mixing valves, booster pumps, circulating pumps, pipe sterilization, insulation, backflow preventers, storage tanks, connections to equipment furnished in another section of work.
  6. Natural gas piping system including regulators, connections to equipment furnished in another section of work and service connections.
  7. Hangers, anchors, sleeves, metal supports, and channels as required for work under this section including sound isolators where indicated.
  8. Piping and valve identification.
  9. Furnishing and installation of plumbing fixtures and trim.
  10. Final piping connections to all fixtures, equipment, including equipment furnished under other sections.
  11. Miscellaneous steel work - floor sleeves, inserts, supports, hangers, etc.
  12. Testing, adjusting of completed work, inspections, and instructions.
  13. Shop drawing, submittals, as-built drawings and operation and maintenance manuals.
  14. Flashing and counter flashing.
  15. All rigging, transportation and associated work necessary for placement of all equipment in the final location shown.

- 16. Concrete coring, cutting and patching as a result of this work.
- 17. Trenching, backfilling and compacting for work under this section.

### 1.3 REFERENCE AND STANDARDS

- A. Regulatory compliance: All work performed under this Division shall comply with the latest currently adopted editions of all codes and regulations. The following references and standards are hereby made a part of this Section and work shall conform to applicable requirements herein except as otherwise specified herein or shown on the Drawings.
- B. Codes, Laws, Safety Rules & Regulations, and Standards: Conform to all applicable codes, laws, safety rules & regulations and standards as stated herein and as described in Division 1, including but not limited to the following:
  - 1. Uniform Building Code, 2007 Edition
  - 2. Uniform Plumbing Code, 2007 Edition
  - 3. Uniform Fire Code, 2007 Edition
  - 4. California Electric Code (CEC).
  - 5. State of California Administrative Code (CAC) Title 8.
  - 6. California Code of Regulations (CCR), Titles 17, 19, 21, 22, and 24.
  - 7. Comply with all ADA and California Title 24 requirements for disabled access.
- C. 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. Comply with the latest edition of all applicable standards:

AGA	American Gas Association
ANSI	American National Standard Institute
ASME	American Society of Mechanical Engineers
ASSE	American Society of Sanitary Engineers
ASTM	American Standards for Testing and Materials
AWWA	American Water Works Association
CAL-OSHA	Occupational Safety & Health Administration
NBS	National Bureau of Standards
NEMA	National Electrical Manufacturer's Association
NCPWB	National Certified Pipe Welding Bureau
NFPA	National Fire Protection Association
PDI	Plumbing and Drainage Institute
UL	Underwriter's Laboratories
- D. Minimum requirements: The requirements of these Specifications are the minimum that will be allowed, unless such requirements are exceeded by applicable codes or regulations, in which the local regulatory code or regulation requirement of this competition shall govern.
- E. Nothing in the specifications or drawings shall be construed to permit deviation from the requirements of governing codes unless approval for said deviation has been obtained from the legally constituted authorities having jurisdiction and from the Owner's Representative.

JW McClenahan

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**1.4 INSPECTIONS**

- A. Inspections: All work shall be regularly inspected by the authority having jurisdiction. Certificates of approval shall be delivered to the Owner's Representative. Be responsible for notifying the authority having jurisdiction when work is ready for inspection.

**1.5 SERVICE CONNECTIONS**

- A. Coordinate with Site Utilities Contractor for connection to onsite utilities. Verify that site utility sizes and services correspond with building services. Refer to civil utility drawings for site utility piping.
- B. Gas Service: The Contractor shall be responsible for the gas piping inside of the building as shown on the drawings. All items served with gas shall be operated at full fire and adjusted by the Contractor. Make all required adjustments to main gas pressure regulators.
- C. Sanitary Sewer: The Contractor shall be responsible for the soil and waste piping outside of the building within five feet (5') of the foundation and within the building itself.
- D. Domestic Water: The Contractor shall be responsible for the domestic water service outside of the building within five feet (5') of the foundation and within the building itself.
- E. Storm Drain: The Contractor shall be responsible for the storm drain service outside of the building within five feet (5') of the foundation and within the building itself.

**1.6 QUALITY ASSURANCE**

- A. Qualifications:
  - 1. For the actual installation, and testing of work under this section, use only thoroughly trained and experienced work personnel completely familiar with the items required and the manufacturer's current recommended methods of installation.
  - 2. The execution of the work shall be in strict accordance with the best practice of the trades, the intent of this specification, and all codes and ordinances.
- B. Products: All materials and equipment installed as part of this work shall be new, and the manufacturer's current model.

**1.7 INSTALLATION**

- A. Bring to the Owner's attention prior to installation, any conflicts with other trades which will result in unavoidable contact to the equipment, piping, etc., described herein, due to inadequate space, etc.
- B. Bring to the Owner's attention any discrepancies between the specifications and field conditions, changes required due to specific equipment selection, etc., prior to installation.

**1.8 SYSTEM ACCEPTANCE**

- A. Final Review: Request a final review prior to system acceptance after:

1. Completion of the installation of all systems required under the Contract Documents.
2. Submission and acceptance of operating and maintenance data.
3. Completion of pipe, valve and equipment identification.
4. Satisfactory operation of all systems.

B. Acceptance shall be contingent on:

1. Completion of final review and correction of all deficiencies.
2. Submission of as-built drawings.

### 1.9 SUBMITTALS

- A. Submit shop drawings and product data.

### 1.10 RECORD DRAWINGS

- A. Record of Job Progress: Keep an accurate dimensional record of the "As-built" locations of all work as required.

- B. "As-Built" documentation shall be transmitted to the Owner within thirty (30) days after Owner's acceptance of the completed installation. As-built documentation shall include the following (Unless noted elsewhere, furnish number of copies indicated):

1. One (1) copy of final AutoCAD™ drawing files shall also be provided on CD disk, for each drawing.
2. Two (2) sets of manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.
3. Two (2) sets of operation and maintenance data updated to include submittal review comments and any equipment substitutions.
4. Manufacturers literature, reports and operation and maintenance data shall be in a labeled three (3) ring binder.

### 1.11 OPERATION AND MAINTENANCE DATA

- A. The installing contractor shall provide:

1. All literature and instructions provided by the manufacturer describing proper operation and maintenance of any equipment and devices installed.

- B. Include, but not limited to the following: List of all equipment with Manufacturer's name, model number, and local representative, service facilities and normal channel of supply for each item. O&M manuals shall be bound in a three (3) ring binder, with table of contents and tab set for each system. "Operation and Maintenance Manuals" to match "Product Submittals".

1. System Description: Description of start-up and operating procedures.
2. Controls: Diagrams and description of operating sequence of each system.
3. Equipment: Manufacturer's brochures, ratings, certified shop drawings, lubrication charts and data, parts list with parts numbers. Mark each sheet with equipment identification number and actual installed condition.

4. Materials and Accessories: Manufacturer's brochures parts lists with part numbers and lubrication data where applicable. Mark each sheet with equipment identification number or system and location of installation; and to specifically identify which options are provided (in case where data sheet shows multiple options).

## **PART 2 - PRODUCTS**

### **2.1 SOIL, WASTE, AND VENT; GREASE WASTE; AND STORM DRAIN PIPING SYSTEMS**

- A. Above and Below Ground: No-hub cast iron soil pipe and fittings manufactured from gray cast iron with a tensile strength of not less than 21,000 psi, bituminous coated interior and exterior, conforming to the requirements of ASTM A888 and CISPI Standard 301. All pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute. No-hub pipe and fittings shall be AB&I, Charlotte Pipe, Tyler Pipe, or equal.
  1. Underground: No-hub couplings shall comply with CISPI 310 and all requirements of Factory Mutual 1680 Class I, 15 PSI rated working pressure. No-hub couplings shall also comply with ASTM C-1540-02 "Standard Specification for Heavy Duty Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings". No-Hub couplings shall be constructed of Type 304 stainless steel with 305 stainless steel worm drive screws. The worm drive clamps shall have a hexagon head to accept a 3/8 inch socketed torque wrench. The clamps shall be tightened to a minimum of 80 inch pounds. (Single corrugated shield, 4 band 80 inch pound torque or 2 band 125 inch pound torque minimum). The gasket material shall be neoprene rubber meeting the requirements of ASTM C-564.
  2. Aboveground: No-hub couplings shall be standard grade no-hub couplings constructed of a stainless steel shield and clamp assembly conforming to CISPI 310 with a neoprene (elastomeric) sealing sleeve conforming to the requirements of ASTM C564.
- B. Pump discharge piping: Schedule 40 galvanized steel pipe or cast iron, no hub or DWV copper with fittings to match enclosed installation.

### **2.2 DOMESTIC HOT AND COLD WATER PIPING SYSTEMS**

- A. Water Piping Above Ground: Copper Tube: Type "L", hard-drawn temper; ASTM B88 copper tubing with ANSI B16.22 wrought copper sweat type fittings or "T-drill". Pipe 2-1/2 " and Larger maybe Victaulic copper fittings at contractor's option.
  1. Solder for Copper Piping: Lead-free, antimony-free, cadmium-free, non-toxic solder, 95.5% tin, 4% copper and 0.5% silver for 1/2" to 2", and Harris 15% silfos for 2 1/2" and larger.
  2. At Contractor's option, pipes 3" and larger can be ASTM A312 stainless steel type 316 seamless schedule 10 with Type 316 stainless steel grooved fittings conforming to ASTMN A403 or stainless steel Type 316 butt-welded fittings.



### 2.3 NATURAL GAS PIPING SYSTEM

- A. Natural Gas Piping Above Ground: ASTM A53 schedule 40, Grade A, black steel pipe with ANSI 150 lb. ANSI B16.3 malleable iron screwed fittings for pipe sizes 2½ inches and smaller, and ANSI B16.9 standard weight, seamless butt type welded fittings for pipe sizes 3 and larger. For pipes and fittings outdoors, use hot dipped galvanized steel pipe and fittings.

### 2.4 CONDENSATE AND INDIRECT WASTE PIPING SYSTEMS

- A. ASTM B306 DWV copper pipe and fittings for 1¼" and larger. ASTM B88 Type "M" for 1" and smaller.
- B. Solder for Copper Piping: Lead-free, antimony-free, cadmium-free, non-toxic solder, 95.5% tin, 4% copper and 0.5% silver.
- C. No-hub C.I. pipe and fittings are acceptable alternate per Part 2 – Products, Section 2.1.A.2.

### 2.5 UNIONS AND FLANGES

- A. Unions or flanges shall be furnished and installed at each threaded connection to all equipment or valves. The unions or flanges shall be located so that the piping can be easily disconnected for removal of the equipment, tank, or valve, and shall be of the type specified in the following schedule.
  - 1. Unions:
    - a. Black Steel Pipe: 250 pound screwed black malleable iron, ground joint, brass to iron seat.
    - b. Galvanized Steel Pipe: 250 pound screwed galvanized malleable iron, ground joint, brass to iron seat.
    - c. Copper Tubing: 150 pound cast bronze or copper, ground joint, nonferrous seat with cast bronze unions for sizes 2" and smaller, flange for sizes larger than 2", by Walseal, Nibco, Mueller or Elkhart.
    - d. Dielectric Insulating Unions: EPCO, or equal, dielectric nut type or flange type unions with gasket material suitable for service and temperature in which they are required. Install at all connections between ferrous and non-ferrous piping.
  - 2. Flanges: Tube Turn or approved equal, raised face 150 pound class forged steel, weld, neck or slip-on type conforming to ASA B16.5 and ASTM A181. For copper piping systems, provide flanges conforming to ANSI B16.24. The faces of the flanges being connected to be alike in all cases. Locate flanges so that the piping can be easily disconnected for removal of the equipment or valve. Gasket material shall be of material suiting the service of the opening system in which installed and which conforms to its respective ANSI Standard (A21.11. B16.21). Provide materials that will not be detrimentally affected by the chemical and thermal conditions of the fluid being carried.

**2.6 PIPE SUPPORTS, ANCHORS, HANGERS, AND SEISMIC PIPE BRACING**

- A. Unless otherwise detailed on the drawings, all piping shall be supported with, B-Line, Super Strut, Tolco, Unistrut or equal, pipe hangers and supports. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Provide felt lined hangers for copper piping systems.
- B. Special pipe supports for piping in equipment rooms, and other locations where shown on drawings shall be constructed as detailed on drawings. Unless otherwise shown on drawings, support channels, frames, brackets, and legs of special supports shall be made of B-Line, Super Strut, Tolco, Unistrut, or equal channels, attaching clips, pipe clamps, and other required accessories. Piping installed within partitions and connected to plumbing fixture trim shall be securely attached to adjustable stud brackets, not more than 2-feet away from and on the inside of wall penetration. Piping installed within partitions and connected to plumbing fixture trim shall be securely attached with engineered methods that comply with IAPMO PS 42-96. These shall be Hubbard Enterprises/Holdrite® support systems, or equal.
- C. Hanger Rods: All threaded rods are acceptable.
- D. Finish of all pipe supports attachments, hangers, etc., shall be galvanized or cadmium plated.
- E. Steel for Equipment Support: Support steel shall be of new material conforming to ASTM A36, latest edition. Steel hangers shall have a safety factor of 4.0 or greater.
- F. Miscellaneous Steel, Bolts, Nuts, Washers, Etc.: Miscellaneous steel angles, channels, brackets, rods, clamps, etc., shall be of new materials conforming to ASTM A36.
- G. Concrete Anchors:
1. For New Concrete Slabs with Metal Decking: B-Line, Hilti, Red Head, or equal, steel deck inserts or wedge type expansion anchors.
  2. For New Concrete Floor or Base: B-Line, Hilti, Holdrite "Hangover System", Red Head, or equal; hook bolts, wedge type expansion anchors, or Deco Standard adjustable concrete anchors.
  3. For Existing Concrete Slabs: B-Line, Hilti, Red Head, or equal, self-drilling concrete anchors. Locate anchors to clear rebars.
  4. Maximum loading on inserts and rods shall not exceed 75 percent of ratings.
- H. Insulated pipes shall be supported with Tolco, or equal, pipe hanger shield with waterproofed calcium silicate insulation encased in a galvanized sheet metal shield (conforming to ASTM A-527) completely around the pipe. Shield shall be 26 gauge for pipes up to 1½", 22 gauge for 2", 20 gauge for 2½" to 8" in size, and 16 gauge for 10" and larger. Insulation shall be same thickness as pipe insulation. Shield length not less than three (3) times the insulation outside diameter; twelve inches (12") minimum length at each hangers. Locate shield centrally under each hanger where the insulation rests on hanger. Vapor barriers and jacketing continuous over insert.
1. Pipe shield Insulation: Calcium silicate, 100 psi minimum average compressive strength, asbestos free, treated with a water repellent,  $K=0.38 \text{ btu-in.}/(\text{Hr. Ft}^{20}\text{F})$ .

2. Structural inserts shall be a high density calcium silicate with a minimum compressive strength of 600 psi. Inserts shall be asbestos free and treated with a water repellent coating. The manufacturer shall provide documentation for that the pipe shields have the required minimum capacities rated for seismic loads.
  3. Glue shall be industrial strength contact cement with a minimum peel strength of 23 lbs per inch of width.
  4. Install pipe shields in accordance with the manufacturer's instructions.
- I. Provide pipe supports and seismic bracing in accordance with UPC. Provide steel bracing as shown and specified to resist earthquake loads, as required for UBC Seismic Zone IV. As a minimum, provide seismic bracing for the following:
1. All natural gas piping greater than or equal to 1" nominal diameter.
  2. All piping greater than or equal to 2½" nominal diameter.
  3. All piping suspended by individual hangers 12" or less in length, as measured from the top of the pipe to the bottom of the support where the hanger is attached, need not be braced.
  4. Piping smaller than indicated in the guidelines shall be provided with bracing as specified for the smallest size indicated. The entire water distribution system shall be properly braced and will not move due to the action of quick closing of valves.
  5. Cast iron no-hub pipe, where the top of the pipe is 12" or more from the supporting structure, shall also be braced on each side of a change in direction of 90 degrees or more. Riser joints shall be braced or stabilized between floors.
  6. All trapeze assemblies supporting pipes shall be braced to resist the forces by considering the total weight of all the elements on the trapeze.

## 2.7 ESCUTCHEONS, FLASHINGS AND SLEEVES

- A. Provide sleeves for each pipe passing through concrete footings, foundations, walls, partitions, floors, and roofs.
- B. Piping penetrating below grade exterior walls and floors, and floors in all food service areas including pantries, where the floor is above an occupied space, shall be sleeved and made watertight.
  1. Seals shall be modular mechanical type consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and the opening, zinc galvanized plated bolt and nut, Thunderline Corporation "Link-Seal" with "Link-Seal" WS series steel wall sleeve, or equal.
- C. Sheet metal pipe sleeves: Fabricate from 26 gauge galvanized sheet metal, R. K. Industries, or equal.
- D. Set all pipe sleeves and inserts in place before concrete is poured. Coordinate the placing of these items to avoid delaying concrete placing operations.
- E. Sleeves for insulated piping shall be of adequate size to accommodate the full thickness of pipe covering with clearance for packing and caulking.
- F. Caulk space between sleeve and pipe or pipe covering through rated walls, partitions, and floors with fire rated, incombustible, UL listed, permanently plastic, leaving a finished, smooth appearance. Fire stopping shall be in accordance with specification.

## G. Escutcheons, Finish and Plates:

1. Provide escutcheon plates where exposed pipes pass through walls, ceilings, or floors, in all finished rooms and conspicuous locations. Provide chrome or nickel plated plates sized to fit pipe and pipe covering and give a finished appearance. Escutcheons held in place by set screws allowing enough clearance to care for expansion and shall be sufficient size to cover the opening around the pipe.

**2.8 PIPE ISOLATION**

- A. All piping which is not isolated from contact with the building by its insulation shall be installed with a manufactured type isolator. Isolators shall be Hubbard Enterprises "Holdrite Silencer", or equal. Piping shall be installed and supported in a manner to provide for expansion without strains. Guides shall be properly installed to ensure this requirement.

**2.9 PIPE INSULATION**

- A. General: Conform to NFPA Section 90A, with special regard to the fire hazard classification requirements of ASTM E84 and NFPA No. 255, latest revision, including vapor barriers and adhesive. All insulation shall be UL listed and shall meet all code requirements, minimum California State Energy Code Title 24. Insulation shall be Owens Corning, Johns-Manville Corp., or equal.

- B. Indoor Piping - Fluid Temperature Range (105°F and Above):

<u>Pipe Diameter</u>	<u>Insulation Thickness</u>
Runouts (1" max) less than 12'-0"	1.0"
1" and less	1.0"
1¼" - 2"	1.0"
2½" - 4"	1.0"
5" - 6"	1.5"
8" and Larger	1.5"

- C. Outdoor Piping - Fluid Temperature Range (105°F and Above):

<u>Pipe Diameter</u>	<u>Insulation Thickness</u>
Runouts (1" max) less than 12'-0"	1.0"
1" and less	1.0"
1¼" - 2"	1.0"
2½" - 4"	1.0"
5" - 6"	1.5"
8" and Larger	1.5"

- D. Insulate fittings, valves, joints, expansion joints, and couplings with insulation of same material and thickness as adjoining pipe. Use pre-molded fiberglass covers or radical mitered segments of pipe insulation. For valves, expansion joints, fittings and accessories requiring servicing or inspection, insulation shall be removable and replaceable without damage. Concealed items shall be labeled. Unions and flanges, strainers, air chambers and water hammer arrestors, need not be insulated.

- E. All insulation shall be continuous through walls, sleeves, pipe supports and hangers, and other pipe penetrations.

- F. For exterior applications and piping exposed to weather, provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover piping and all fittings with 0.016" aluminum or stainless steel jacket (meeting ASTM B209) with moisture barrier, and with two 3/8" wide 0.015" thick aluminum or 0.010" thick stainless steel bands per 3 feet section (18" on center), completely watertight. Lap all joints 2" minimum and seal per manufacturer's recommendations. Locate seams on the bottom side of horizontal piping.

## 2.10 VALVES

### A. General:

1. Provide all valves of first quality of approved manufacturer, have proper clearances, and be tight at the specified test pressure. Mark on each valve the maker's name or brand, the figure or list number, and the guaranteed working pressure cast on the body and cast or stamped on the bonnet, or provided with other means of easy identification.
2. All valves must be of the product of one manufacturer, except for special application. Figure numbers of manufacturers are listed to indicate the types selected for design, performance and standard of quality and appearance.
3. Sizes: Same size as upstream pipe, unless otherwise indicated.
4. Operators:
  - a. Lever handles on quarter-turn valves, six inch (6") and eight inch (8") and larger gear operated, except for plug valves. Provide plug valves with square heads and operating wrench.
  - b. Provide gear operator for valves eight inch (8") or larger.
5. Extended stems: Where insulation is indicated or specified, provide extended stems arranged to receive insulation.
6. End Connection: Valves 2" and under shall be sweat or threaded, 2½" and larger shall be flanged or full lug style.
7. Figure numbers of manufacturers are listed to indicate the types selected for design, performance and standard of quality and appearance.

### B. Butterfly Valves: MSS SP-67; Class 125, 200 psi WOG, ductile iron body, lug pattern, alum bronze disc, stainless steel stem, EDDM seals.

1. Valves 2" and Smaller: Use ball valve.
- 2.
3. Valves 2½" and Larger: Red & White #L615, Nibco LD200-3, or equal.

### C. Ball Valves: MSS SP-110; rated for 150 psi saturated steam pressure, 600 psi WOG pressure; full port, two or three piece bronze body construction, chrome plated solid bronze vented ball, blowout proof stem, reinforced "Teflon" seat and seals, separate adjustable packing gland and nut, and vinyl covered steel handle. Provide locking type handle on all valves.

1. Valves 2" and Smaller: Red & White 5044F/5049F, Nibco T/S-585-70, or equal.
2. Valves 2½" and Larger: Use butterfly valve.

### D. Check Valves:

1. Swing Check Valves: 2-Inch and Smaller: MSS SP-80; Class 125, 200 psi WOG, cast-bronze body and cap conforming to ASTM B 62; with horizontal swing, Y-pattern, and bronze disc. Provide valves capable of being refitted while the valve remains in the line.
  - a. Red & White #236/#237, Nibco T/S-413B, or equal.

2. Swing Check Valves: 2½-Inch and Larger: MSS SP-71; Class 125, 200 psi WOG, cast iron body and bolted cap conforming to ASTM A 126, Class B; horizontal wing, and bronze disc or cast-iron disc with bronze disc ring, flanged ends. Provide valves capable of being refitted while the valve remains in the line.
    - a. Red & White #435, Nibco F-918-N, or equal.
  3. Non-Slam Check Valves: Provide non-slam check valves on the discharge of pumps. Check valves to be silent closing, class 125, iron body, bronze mounted spring leaded center guide.
    - a. Valves 2" and Smaller: Red & White #232/233, Nibco T/S-480, or equal.
    - b. Valves 2½" and Larger: Red & White, Nibco F-910-B, or equal.
  4. Gate Valves
    - a. Gate Valves: 2-inch and Smaller: MMS-SP-80, Class 150, 300 psi WOG,
    - b. cast-bronze body, block pattern, union bonnet, rising stem, solid wedge. Provide valves capable of being refitted while the valve remains in the line.
    - c. Red & White #298, Nibco T/S-134, or equal.
    - d. Gate Valves: 2 ½ " - Inch and Larger: MSS SP-71; Class 125, 200 psi WOG, cast iron body, bolted, outside screw and yoke, rising stem, solid wedge, bronze mounted. Provide valves capable of being refitted while the valve remains in the line.
- E. Combination Pressure and Temperature Relief Valves: Provide ASME labeled, adjustable bronze spring and diaphragm combination pressure and temperature type with test lever and automatically reseating type thermostatic element, Wilkins, Watts, or equal. Relief valve shall be type as recommended by the water heater and/or equipment manufacturer.
- F. Natural Gas Valves: Provide AGA/CGA listed gas valves for natural gas piping system.
1. Valves 2" and smaller: MSS SP-110; full port, two piece body, blowout proof stem, lever handle, screwed ends, 600 psi WOG rated, AGA/CGA/UL listed and FM approved, Red & White #5044F, or equal.
  2. Valves 2½" to 6": Provide lubricated plug type, bronze body, standard port, spring balanced plug & stem, ¼ turn operation, flanged ends, and include operating wrench and locking device, UL/CGA Listed, Homestead #612, or equal.
- G. Balancing Valves: Fully assembled, forged brass body, 304 stainless steel parts, EPDM O-rings, 20 mesh stainless steel strainer, nickel-plated brass ball valve, 400 psi/250°F rated, accessible flow control cartridge, ports for testing, Griswold Isolator "Y" Series, or equal.
- H. Diaphragm Operated Pressure Reducing Valves: All bronze body and bell housing, built-in bypass, Buna-n diaphragm, replaceable stainless steel seat, union end or flanged end connection, serviceable in-line, pressure rated to 300 psi, maximum temperature of 180°F, ASSE listed 1003 and IAPMO listed. Outlet pressure setting and sizes shall be as shown on drawings. Use for flow of 25 gpm and less.
- I. Pilot-Operated Pressure Reducing Valve: ASTM A536 ductile iron body, cast-iron disc retainer and diaphragm washer, bronze trim, buna-N rubber disc, nylon reinforced buna-N rubber, stainless steel stem, nut and spring, 150 lb. rated, and epoxy-lined . Use for flows greater than 25 gpm.

- J. Gas Regulators: American Meter Company Series 1200, 1800, 2000, 3000, and RFV, or equal. Where size is not shown on the drawings, Contractor shall size and provide gas regulators based on gas demand, available inlet pressure and required outlet pressure for each application. Provide gas regulator vent line(s) piped to outside, or as indicated on the drawings.

## 2.11 TRAP PRIMER VALVES

- A. Corrosion resistant brass containing no springs or diaphragms, activated by a 5 to 10 psi pressure drop, provide with distribution unit where serving 2 to 4 drains, ASSE 1018 certified and Listed with IAPMO. Precision Plumbing Products Model P-1 & P-2 with DU Series distribution unit, or equal.
- B. Provide trap primers for all floor drains including piping from floor drain to trap primer valve. Provide shut-off valve upstream of trap primer valve.
- C. When concealed, provide access panel for maintenance or replacement. Use size appropriate for access.

## 2.12 WATER HAMMER ARRESTORS (SHOCK ABSORBERS)

- A. Provide water hammer arrestors in water lines to equipment or fixtures having quick closing valves, flush valves, sensor operated metering faucets, mechanical metering faucets, foot pedal valves, knee operated valves, and any equipment that might produce water hammer. Sizing shall be per PDI sizing criteria.
- B. Water hammer arrestors shall be certified by the Plumbing and Drainage Institute (PDI). Water hammer arrestors shall have threaded stainless steel casing, partially filled with liquid and charged with gas as required for normal line pressure, stainless steel or neoprene bellows, J.R. Smith "Hydrotrol", Zurn "Shocktrol", or Wade "Shokstop".
- C. When concealed, provide access panel for maintenance or replacement. Use size appropriate for access.

## 2.13 THERMOMETERS

- A. Type: Weksler, or equal, Adjustable angle type, small bulb gas actuated dial thermometer, inert gas filled, stainless steel bulb and case, direct mounted, 4½" dial size, stainless steel rotary movement, uniformly graduated scales, accuracy of plus or minus 1% of range span, adjustable pointer, fast response. Provide gauge cocks between gauges and gauge tees on piping system. Install for easy reading from floor with clear sight line.
  - 1. Domestic Cold Water: Range of 0 - 120°F.
  - 2. Domestic Hot Water: Range of 30 - 240°F.
- B. Separable Sockets: Brass 150 psi at 250°F, with 2½" extension necks. Install vertically in horizontal runs of pipe.
- C. Thermometer Wells: Install in piping for all thermometers. Construct to withstand pressure, temperature, and fluid in which installed with 2½" extension necks. Install vertically in horizontal runs of pipe.

- D. For thermometers and wells through insulation, provide extensions to compensate for insulation thickness.

## 2.14 PRESSURE GAUGES

- A. Weksler, or equal, drawn steel or brass case, glass lens, 4½" dial, 1% accuracy, ANSI B40.1 Grade 2A, phosphor bronze, bourdon tube, brass bottom connection.
  - 1. Scale: White coated aluminum with permanently etched markings, black graduations and numerals, 270° arc scale.
  - 2. Range: Dial range approximately twice the working pressure.
- B. Provide pressure gauge cocks between pressure gauges and gauge tees on piping system. Construct gauge cock of brass with ¼" female NPT on each end, and "T" handle brass plug. Siphon: ¼" straight coil constructed of brass tubing with ¼" male NPT on each end. Snubber: ¼" brass bushing with corrosion resistant porous metal disc, through which pressure fluid is filtered. Select disc material for fluid served and pressure rating. Manufacturer shall be same as for gauges.

## 2.15 DRAINS (SEE PLUMBING SCHEDULES)

- A. Conforming to ANSI A112.21.1M. Drains shall be manufactured by J.R. Smith, Wade, or Zurn.
- B. Coated cast iron body, except as noted, with integral double drainage flange, weep holes and inside caulked bottom and no-hub outlet.
- C. Provide cast iron P-trap at floor drains, floor sinks and trench drains. All floor drains to have trap primers as shown.
- D. For Drain Schedule, Refer to the Drawings.
- E. Coordinate floor drain, area drain, trench drains, and floor sink rim elevations to be flush with finish floor and at low point of floor.

## 2.16 CLEANOUTS

- A. Conforming to ANSI A112.36.2. Cleanouts shall be manufactured by J.R. Smith, Wade, or Zurn.
- B. Cast bronze, full size up to four inch.
- C. Floor Cleanouts: J.R. Smith Fig. 4026-U-F-C (Zurn Fig. ZN1400-BP, or Wade 6000-1-S), coated cast iron adjustable floor cleanout with internal bronze plug, scoriated round nickel bronze cover secure to rim.
- D. Wall Cleanouts: J.R. Smith fig. 4422C-U and fig. 4532S-U (Zurn Fig. ZAN8-1468-BP and Z1446-BP, or Wade 8550E w/ 8480R-S), cast bronze taper thread plugs with stainless steel cover. Screw length as required meeting installation requirements. Wall cleanouts shall be located a minimum of 18" above finished floor.



**2.17 ACCESS DOORS AND PANELS – INSTALLED BY OTHERS**

- A. Furnish under this Division where shown, and required by Regulatory Agencies and for access of all concealed valves, water hammer arrestors, unions, etc., even though access doors are not shown for Plumbing work. Sizes: Use size as required for unobstructed access to item being served. 24" x 24" inches minimum for ceilings and 12" x 12" minimum for walls. Furnish fire rated doors when located in fire rated construction. Mark each door to accurately establish its location.
- B. Non Rated Access Doors: Access door and frame shall be fabricated from 14 gage, type 304 stainless steel with a No. 4 satin finish. The door shall have rounded safety corners and a concealed piano hinge. Frame shall be one piece construction with no mitres or welds on the face. Latch shall be cylinder lock operated. Provide Elmdor DW Series dry wall access door, or equal.
- C. Fire Rated Access Doors: Access door and frame shall be fabricated from 16 gage, type 304 stainless steel with a No. 4 satin finish. The door shall have a heavy duty spring to provide positive latching when closed, and interior latch release slide enabling door to be opened from the inside. Door shall be fire rated by U.L. for 1½ hours, "B" label, and meet ANSI-UL10B standard. Exterior latch shall be recessed and operated using ring attached to the sliding bolt. Latch shall be cylinder lock operated. Provide Elmdor FR Series access door, or equal.

**2.18 IDENTIFICATION OF PIPING**

- A. All piping are to be identified as follows: MSI Marking Services Inc., or equal, pressure sensitive self-sticking pipe markers consisting of pipe content wording and arrow indicating directions of flow on ANSI color background. Arrow and wording are two separate markers which shall be placed immediately adjacent to each other. Provide at each end of each marker, two and one-fourth inch (2¼") wide self-sticking clear tape around periphery of pipe or insulation to further secure marker. All markers shall be applied to clean surfaces free of dust, grease, oil or any other material which will prevent adhesion. Install after cleaning, painting and insulation is complete. Pipe identification shall comply with ANSI A13.1 "Scheme for the Identification of Piping Systems".
- B. Location and visibility for pipe identification:
  - 1. On all horizontal runs spaced twenty feet (20').
  - 2. Where capped piping is provided for future connections, provide legible and durable metal tags indicating symbol identification.
  - 3. Attention shall be given to visibility with reference to pipe markings. Where pipelines are located above or below the normal line of vision, the lettering shall be placed below or above the horizontal centerline of the pipe.
- C. Color Coding of Piping:
 

<u>ANSI Color</u> <u>Service</u>	<u>Color of</u> <u>Color Field</u>	<u>Color of</u> <u>Text</u>
Condensate Drain	Yellow	Black
Domestic Cold Water	Green	White
Domestic Hot Water	Yellow	Black
Domestic Hot Water Return	Yellow	Black
Domestic Hot Water 140°	Yellow	Black
Domestic Hot Water Return 140°	Yellow	Black

Domestic Tempered Water	Yellow	Black
Domestic Tempered Water Return	Yellow	Black
Natural Gas	Yellow	Black
Non Potable Water	Yellow	Black
Sanitary Sewer	Green	White
Sanitary Vent	Green	White
Storm Drain	Green	White
Storm Drain Overflow	Green	White

## D. Size of Legend Letters:

<u>Outside Diameter of Pipe or Covering</u>	<u>Minimum Length of Color Field</u>	<u>Minimum Size of Text</u>
1/2" to 1-1/4"	8"	1/2"
1 1/2" to 2"	8"	3/4"
2 1/2" to 6"	12"	1 1/4"
8" to 10"	24"	2 1/2"
Over 10"	32"	3 1/2"

- E. All exposed water piping and valves downstream of backflow devices shall be properly identified and labeled as "Non-Potable" water.

**2.19 VALVE TAGS**

- A. All valves shall have brass identification tag as follows: Brady Perma-Code, MSI Marking Services Inc., or equal, Brass valve identification tag secured with brass chain and "S" hook. Tags shall bear the service identification and numerical identification of the valve.
- B. Tags:
1. Minimum 1 1/2 inches round for plumbing.
  2. No. 19 BS gauge brass with stamped numbers and letters filled in with black enamel paint. Engraving, ink, dye and vinyl fill are not acceptable.
  3. Identifying number and system letter. Top line shall be 1/4" characters and should abbreviate the service. Example: Hot Water - HW. The second line shall be 1/2" characters and should list the valve number. Example: 1<sup>st</sup> floor shall begin 101, second floor shall begin 201.
  4. Provide on: All valves and controls.
- C. Where shut-off valves are installed on branch line leading to emergency safety equipment (emergency showers and eyewashes), the valves shall be locked in the open position and labeled for identification.

**2.20 EQUIPMENT IDENTIFICATION**

- A. Provide engraved plastic nameplates on all plumbing equipment, including but not limited to the following: Pumps (all types), water heaters, heat exchangers, and tanks. Provide nameplates on each piece of equipment and at the disconnect, and also the breaker. Nameplates shall conform to the following, provided the equipment can accommodate the minimum sizes outlined:
1. Black background with white lettering.

2. Sizes: Equipment 2"x4", disconnect 1"x2½, breaker 1"x3".
  3. Lettering shall be ¾" (¼" minimum) or sized for the maximum per nameplate.
  4. Nameplate shall be provided with both adhesive backing and screw holes to insure permanent application.
  5. Material shall be 2 ply 1/16" thick with beveled edges.
- B. Properly identify each piece of equipment and controls pertaining thereto by nameplates mounted on equipment and controls using round head brass machine screws, pop rivets or contact cement. Cardholders in any form not acceptable. Install with corrosion resistant mechanical fasteners and adhesive and seal with clear lacquer.
- C. Place warning signs on machines driven by electric motors which are controlled by fully automatic starters, in accordance with Article 3281, General Industry Safety Orders.
- D. Small devices, such as inline pumps, may be identified with tags.
- E. Identify control panels and major control components outside panels with plastic nameplates.
- F. Identify equipment out of view behind access doors, in unfinished rooms on the face of the access door.
1. All gas pressure regulators shall be identified with proper warning signs. The upstream pressure shall be identified with a metal tag permanently attached to the regulator and state (with appropriate wording to state actual gas pressure conditions): "Warning: ¼ to 5 pounds natural gas pressure. DO NOT REMOVE", or similar.
- G. Emergency Safety Equipment: Emergency units shall be identified with highly visible signs in accordance with ANSI Z358.1 and shall comply with the provisions of ANSI Z535.1 through ANSI Z535.5. Signs shall utilize a white background with green lettering. Graphics and lettering shall be of the correct size and format. Signs shall be furnished by manufacturer of the safety equipment and shall be installed in accordance with manufacturer's instructions and ANSI standards.

## 2.21 VALVE AND EQUIPMENT CHARTS

- A. Provide five typewritten schedules giving numbers, service and locations, and notations of open or closed, of all tagged valves. Enclose each schedule in separate transparent plastic binder. List piping systems with symbol and color coding on pipe identification chart. List valve model numbers and symbol for service corresponding to piping symbol on valve identification chart. Provide small "key plan" identifying valves as related to column lines. Schematic flow diagrams of each piping system indicating:
1. Location and function of each tagged valve.
  2. Type, size and essential features of each system.

## 2.22 STRAINERS

- A. Wye type, with Monel or stainless steel strainer cylinder and gasketed machined strainer cap, bronze body, threaded, 250 pound, Metraflex, or equal.

**2.23 FLEXIBLE CONNECTORS**

- A. Materials of construction and end fitting type shall be consistent with pipe material and equipment/ pipe connection fittings. For potable water service, connectors shall be UL classified in accordance with ANSI/NSF 61-1977 standards.
- B. Flexible connectors attached to fuel gas lines, shall be specifically manufactured for fuel gas applications and certified by the American Gas Association.
- C. Flexible connectors shall be flexible corrugated hose and braid, stainless steel, 850°F rated, 125 psi minimum, 150 lb flange for pipe sizes 2-1/2" and larger, and threaded ends for 2" and smaller, as manufactured by The Metraflex Company, or equal. Provide flexible metal hose assembly as shown on the drawings.

**2.24 SEISMIC AND THERMAL EXPANSION LOOPS**

- A. All piping passing through or crossing building seismic joints and piping requiring thermal expansion compensation, shall contain a flexible expansion loop designed for seismic movement. Flexible loops shall impart no thrust loads to system support anchors or building structure. Flexible loops shall be located at, or near the building seismic joint. A vertical support hanger, located within 4 pipe diameters, shall be installed on each side of the flexible loop. Each hanger shall be transversely and longitudinally braced per code. Seismic bracing shall not pass through building seismic joint and shall not connect or tie together different sides or parts of building structure. Flexible loops shall be capable of move in the  $\pm X$ ,  $\pm Y$ , and  $\pm Z$  planes.
- B. Flexible expansion/seismic loops shall consist of two flexible sections of hose and braid, two 90° elbows, and a 180° return assembled in such a way that the piping does not change direction, but maintains its course along a single axis. Flexible loops shall have a factory supplied, center support nut located at the bottom of the 180° return, and a drain/air release plug. Flexible loops shall impart no thrust loads to system support anchors or building structure. Flexible loops may be installed to accommodate both thermal and seismic motion. For steam service, loops must be installed with flexible legs horizontal to prevent condensate buildup. Materials of construction and end fitting type shall be consistent with pipe material and equipment/ pipe connection fittings. For potable water service, connectors shall be UL classified in accordance with ANSI/NSF 61-1977 standards. Flexible expansion/seismic loops to be "Metraloop(r)" as manufactured by The Metraflex Company, or equal.
- C. Loops installed hanging down shall have a drain plug. Loops installed up shall be fitted with an automatic air release valve to purge air from the high point of the loop. Loops installed in any position other than hanging down must have the 180 degree return bend supported. Install loop within four pipe diameters, both upstream and downstream, from a pipe guide or anchor.
- D. Flexible loops attached to fuel gas lines, shall be specifically manufactured for fuel gas applications and certified by the American Gas Association.

**2.25 HOSE BIBBS**

- A. Hose Bibb (HB-1): Bent nose with flange, 3/4 inch inlet flanged female, 3/4 inch hose thread on outlet, vandal-resistant lockshield bonnet, removable wheel handle, atmospheric vacuum breaker, polished chromium plate finish, Zurn Fig. Z1341-PC

- B. Hose Bibb (HB-2): Bronze nickel plated, quarter turn non-freeze hydrant with hose connection, integral vacuum breaker, 3/4" NPT union elbow, connection and loose key handle, stainless steel box with full 180° cover opening, cylinder lock, "Water" cast on cover, Wall Hydrant – Zurn 1330S.

## 2.26 PLUMBING FIXTURES

- A. General: Provide factory fabricated fixtures of type, style and material indicated.
  - 1. Plumbing Fittings, trim and accessories:
    - a. Water Outlets: At locations where water is supplied (by manual, automatic or remote control), provide commercial quality faucets, valves or dispensing devices of type and size indicated. Include manual shutoff valves and connecting stem pipes to permit outlet servicing without shut-down of water supply piping systems. Stop valves shall be provided at each fixture.
    - b. Vacuum Breakers: provide with flush valves and water outlets equipped for hose attachment.
  - 2. Provide materials which have been selected for their surface flatness and smoothness. Exposed surfaces which exhibit pitting seam marks, roller marks, foundry sand holes, stains, decoloration or other imperfections on finished units are not acceptable.
  - 3. Where piping, fittings, trim and accessories are exposed or semi-exposed provide bright chrome plated or polished stainless steel units. Provide copper or brass where not exposed.
  - 4. Escutcheons: Where fixture supplies and drains penetrate walls, provide chrome plated brass escutcheons. Provide box style escutcheons for p-trap penetrations.
  - 5. Stainless Steel: Stainless steel fixtures conforming to ANSI A112.19.3M. Type 302/304, hardest workable temper. Finish shall be No., 4, bright, directional polish on exposed surfaces, or as indicated.
  - 6. Vitreous China: White vitreous china unless otherwise noted. Fixtures conforming to ANSI A112.19.2M. High quality, free from fire cracks, spots, blisters, pinholes and specks; glaze exposed surfaces, and test for crazing resistance in accordance with ASTM C-554.
  - 7. Terrazzo: High quality free from defects, stain resistant.
  - 8. Traps: Lavatory and sink p-traps shall be commercial grade, chrome plated, 17-gauge seamless brass adjustable wall bend, 17-gauge seamless tube, and cast brass slip nuts. Trap shall be provided with box style escutcheon. Traps to have a 2" water seal and rough-in complete. Trap adapter allowed. P-trap shall be BrassCraft Commercial, McGuire, or Zurn Commercial. Trap shall be certified by CSA or other recognized testing authority and bare manufacturers name.
  - 9. Lavatory and sink water supply kits shall be heavy pattern commercial grade and include chrome plated all brass stops. Kits shall have chrome plated flexible copper risers and deep forged brass with setscrew flange, and have EPDM washers. Inlet shall be 1/2" IPS with chrome plated nipple. Supply riser lengths to conform to fixture manufacturer's recommended rough-in dimensions. Outlets shall be 3/8" compression. Stops shall be certified to 200 psi line pressure. Supply kit shall be certified by CSA or other recognized testing authority, bare manufacturers name and comply with the SDWA (Safe Drinking Water Act) "No Lead" restrictions of ANSI NSF 61 Sec. 9. Supply kits shall be Brasscraft Commercial, McGuire, or Zurn Commercial. (Option: Lavatory and sink water supply kits shall be commercial grade and include commercial pattern chrome plated quarter turn brass ball valve with convertible loose key handle. Kits shall have chrome plated flexible copper risers and deep forged brass with setscrew flange. Inlet shall be 1/2" IPS with

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chrome plated nipple. Supply riser lengths to conform to fixture manufacturer's recommended rough-in dimensions. Outlets shall be  $\frac{3}{8}$ " compression. Stops shall be certified to 200 psi line pressure. Supply kit shall be certified by CSA or other recognized testing authority, bare manufacturer and testing mark. Supply kits shall comply with the SDWA (Safe Drinking Water Act) "No Lead" restrictions of ANSI NSF 61 Sec. 9. Supply kits shall be Brasscraft Commercial, McGuire, or Zurn Commercial.)

10. Lavatory grid drains to have chrome plated cast brass strainer (with overflow for lavatories with overflow drains) with brass lock nut. Drain tailpiece shall be 17-ga. seamless brass tube and a minimum 6" long. Provide offset type for ADA accessible fixtures. Grid drain shall be BrassCraft Commercial, McGuire, or Zurn Commercial, and be certified by CSA or other recognized testing authority. Drain body shall bear manufacturers name so as to be visible after installation.
11. Product submittals for p-traps and lavatory grid drains shall include documentation that product is CSA listed or other recognized testing authority. Product submittals for fixture faucets and water supplies shall include documentation that product is ANSI NSF 61 Sec. 9 compliant. Include documentation indicating that water stops are certified to 200 psi line pressure.
12. Water Connections: All fixtures shall have stops or valves. Corrugated tubing or braided hose supply risers are not acceptable.
13. Carriers: Fixture supports for wall hung water closet and urinal plumbing fixtures conforming to ANSI A112.6.1M. Provide floor mounted commercial grade cast-iron supports for fixtures of either graphitic gray iron, ductile iron, malleable iron, or steel as indicated. Provide cast iron nipples and couplings for water closets and urinals. ABS is not acceptable. Carriers shall be manufactured by J.R. Smith, Wade, or Zurn.
14. Fixture Bolt Caps: Provide manufacturer's standard exposed fixture bolt caps finished to match fixture finish.
15. All water closets shall utilize a maximum of 1.60 gallons per flush, and all urinals shall utilize a maximum of 1.00 gallons per flush.
16. All lavatory and sink trim on wheelchair accessible fixtures shall be covered with a white anti-microbial vinyl insulating outer shell. Material shall be flame retardant and fungal and bacterial resistant. Insulating kits shall include covers for drain tailpiece, drain offsets, all p-trap components and hot and cold water supplies including supply risers and angle stops. Insulation kits shall be McGuire "ProWrap", Truebro "Lav Guard", or Zurn.

## 2.27 EMERGENCY SAFETY STATIONS:

- A. Fixture: ADA compliant combination safety station with stay open shower valve and eye/face wash with stainless steel bowl and stay open ball valve, flip top dust covers, and ANSI Z358.1 compliant signage. Guardian Model GBF1909, Encon, or Haws.
- B. Furnish thermostatically controlled emergency tempering valve with dual internal cold water bypass conforming to ANSI Z358.1-1998. Valve shall be a Powers "Hydroguard" Series ES-200 emergency tempering valve, or equal.

## 2.28 JANITOR SINKS:

- A. JS-1:

1. Fixture: 24" x 24" x 12" floor corner mounted terrazzo service sink with stainless steel cap on all sides and tiling flange on (2) sides, and 3" drain with strainer, Florestone Model 82LH & 82RH, Fiat, Stern Williams, or equal.
2. Faucet: Service sink faucet with polished chrome finish, spout, loose key stops, integral vacuum breaker, lever handles, wall brace, pail hook, & ¾" garden hose outlet, Kohler "Kinlock" K-8908.

**2.29 LAVATORIES:**

- A. Public Toilet Rooms: TOTO LT307, wall hung lavatories w/ TOTO TEL5GSC-10 sensor faucets or equal.
- B. Staff Toilet Rooms: TOTO LT307, wall hung lavatories w/ Symmons S-20-0 single handle faucets or equal.

**2.30 WATER CLOSETS:**

- A. Public Toilet Rooms: TOTO CT708, wall hung water closet w/ Sloan WES-111 dual flush valve or equal.
- B. Staff Toilet Rooms: TOTO CT708, wall hung water closet w/ Sloan WES-111 dual flush valve or equal.
- C. Urinals: Evergreen Vitra, wall hung urinals w/ Sloan Royal 186-0.25 flush valve or equal.

**2.31 SHOWER HEADS: SYMMONS 4-141.**

**2.32 PLASTER TRAPS: ZURN Z1184.**

**2.33 REDUCE PRESSURE BACKFLOW PREVENTERS**

- A. Reduced pressure principle backflow preventers consisting of shutoff valves on inlet and outlet, two independently operating, spring loaded "Y" pattern check valves and one hydraulically dependent differential relief valve, air gap drain kit (air gap shall be cast iron or equivalent, plastic is not acceptable), and include accessible test cocks. The assembly shall be rated to 175-PSI water working pressure and a temperature range from 32°F to 140°F. Install backflow preventer at least 12" above floor or ground and in accordance with manufacturer's installation instructions. The assembly shall meet the requirements of ASSE Standard 1013; AWWA Standard Code C511-89; CSA Standard B64-4; and approved by the Foundation for Cross Connection Control and Hydraulic Research at the University of Southern California. All backflow prevention devices must be on the approved list of the San Francisco Water Department. All backflow preventers shall be tested by certified technician hired by the contractor and the results submitted to the San Francisco Water Department. Backflow preventers ¾" to 2" shall be Wilkins Model 975XL, 2½" to 8" shall be Wilkins Model 375, or equal.

**2.34 DOMESTIC HOT WATER STORAGE TANKS**

- A. The storage tank shall be a vertical design with dimensions and capacities as scheduled on the drawings. The tank shall be designed and manufactured in accordance with Section VIII, Division I of the ASME Code for pressure vessels, and stamped for a working pressure of 125 PSI. The storage tank shall be constructed of carbon steel with stainless steel couplings and include angle iron legs with pads, manhole (11" x 15"), lifting lugs, and shall be installed in accordance with ASME Code requirements and manufacturer's standard practice. The interior shall be cement lined, or glass lined equipped with number and size of flexible magnesium anode rod(s) sufficient to provide adequate protection for the tank lining. The tank shall carry a warranty of five years. Exterior of tank shall be hand cleaned and primed. The storage tank shall be factory insulated with R-16 insulation meeting ASHRAE requirements. Install in accordance with manufacturer's installation instructions and provide dielectric connections at tank fittings. Tanks shall be Hanson Manufacturing, or equal.

**2.35 THERMO EXPANSION TANKS**

- A. The potable water expansion tank shall be of drawn steel construction, suitable for domestic water and include a thermally bonded epoxy liner in the water containing area. The tank construction shall be in accordance with Section VIII of the ASME Boiler and Pressure Code, with all welds conforming to ASME Section IX. It shall have a Butyl diaphragm separating the air chamber from the water-containing chamber. Materials of manufacture for the liner and diaphragm and all internal wetted parts shall be FDA approved. Tank shall be ANSI/NSF 61 approved. Tank shall be factory pre-charged at 40 psi. See drawings for capacities, sizes, and model numbers. Expansion tanks shall be Amtrol "Therm-X-Trol", or equal.

**2.36 HOT WATER CIRCULATING PUMPS**

- A. The pumps shall be of the horizontal, oil lubricated type, specifically suitable for domestic water services and rated for a 125 psi working pressure. The pumps shall have ground and polished steel shaft with a hardened integral thrust collar. The shaft shall be supported by two horizontal sleeve bearings designed to circulate oil. The pumps are to be equipped with a mechanical seal with carbon seal face rotating against a ceramic seat. The rotor shall be non-overloading at any point on a pump curve. The motor shall be drip-proof, sleeve bearing, quiet operating, rubber mounted construction. Motors shall have built-in thermal overload protectors. Pumps shall be aquastat controlled. See drawings for capacities, sizes, electrical information and model numbers. Pumps shall be Bell & Gossett iron and bronze booster pump, or equal.

**2.37 THERMOSTATIC MIXING VALVES (SEE PLUMBING SCHEDULES)**

- A. Master mixing valves: Valves for tempered water control shall be a thermostatic type, capable of maintaining water temperature to a set point of plus or minus 5°F within the range of 40°F to 160°F. Valve must compensate for temperature fluctuations due to inlet temperature, or pressure changes. It shall have bronze body construction with non-corrosive parts. Valve construction shall employ poppets which are independently seated, balanced, and self-aligning. Valve must have an expandable restrictor, and a quick acting actuator in order to guarantee precise control when tested in accordance with ASSE 1017 and CSA B125. Dial thermometer, union inlets with strainers and check stops shall be provided. Mixing valves shall have flow capacities at pressure drop across valve as scheduled on the drawings. Valves shall be Lawler,



Powers, Symmons, or equal. Field test and verify temperature setting and make adjustments as necessary to maintain specified outlet temperature.

- B. Point of use mixing valves: Valves for under the counter (single fixture use) shall be a thermostatic type made of solid brass and all internal parts shall be stainless steel or other corrosion material. Valve shall be CSA B125 certified and ASSE 1016 Type T/P listed. The capacity of the valve must be at least 4 gpm @ 45 psig differential, and must control down to 0.5 gpm. Control temperature must be adjustable between 90 and 120°F, with a locking nut to prevent unauthorized or accidental adjustment. The valve shall contain integral checks to prevent crossflow and inlet screens to filter debris. Where valve is exposed under lavatory/sink, the valve shall have a polished chrome finish. Valves shall be Lawler, Powers, Symmons, or equal.
  - 1. Where single temperature tepid water is provided at a lavatory or sink faucet, set mixing valve at 105°F maximum, unless otherwise indicated. Field test and verify temperature setting and make field adjustments as necessary to maintain specified outlet temperature.
  - 2. Where hot and cold water is provided at a lavatory or sink faucet, set mixing valve at 110°F maximum, unless otherwise indicated. Field test and verify temperature setting and make adjustments as necessary to maintain specified outlet temperature.
  - 3. Exception: Metering faucets supplied with factory supplied thermostatic mixing valve will not require this thermostatic mixing valve.
  
- C. Emergency Safety Equipment: Valves for supplying tepid water to emergency safety equipment shall be a thermostatic type. It shall have bronze body construction with non-corrosive parts and have a powerful paraffin filled temperature element, with dual internal cold water by-pass to ensure flow in the event of valve failure or loss of hot water supply. The valve shall provide precise temperature control over a wide range of flow conditions in accordance with ASSE 1017 and shall be ANSI Z358-1 1998 compliant. By-Pass shall respond to changes in temperature and pressure. Dial thermometer, union inlets with strainers and check stops shall be provided. Valves are to be factory set at 85°F. Field test and verify temperature setting and make field adjustment as necessary to maintain specified outlet temperature. Provide stainless steel cabinet where specified. Valves shall be Lawler "911", Powers "HydroGuard" ES Series, or equal.

## PART 3 - EXECUTION

### 3.1 PIPE SUPPORTS

- A. Maximum hanger spacing and minimum rod sizes for horizontal runs of piping shall be as given below:

**SCHEDULE OF HANGER RODS AND SPACINGS**

Horizontal Spacing – Feet

Pipe Size Inches	Rod Size Inches	Steel Pipe	Copper Tubing	Cast Iron Pipe
1/2"	3/8	6	5	-
3/4" - 1"	3/8	8	5	-
1 1/4	3/8	10	6	-
1 1/2	3/8	10	6	5
2	3/8	10	8	5
2 1/2 - 3	3/8	10	10	5

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4"	3/8	10	10	5
5	5/8	10	10	5
6	3/4	10	10	5
8"	7/8	10	10	5

- B. Every branch of piping over three feet (3') long shall have a separate hanger. Support at each horizontal branch connection. Provide at least one (1) hanger per branch.
- C. Support all suspended piping with J-hangers or trapeze hangers and rods.
- D. Hangers and supports shall be adequate to maintain alignment and prevent sagging and shall be placed within eighteen-inches (18") of a joint. Support shall be provided at each horizontal branch connection. Hangers shall not be placed on joints. Make adequate provision to prevent shear or twisting of the pipe or joint.
- E. Support for cast iron no-hub pipes shall be adjacent to joint, not to exceed eighteen inches (18"). Provide hangers on the piping at each side of and within eighteen inches (18") of a no-hub pipe coupling so that the coupling will not bear any weight. Provide supports at every other joint, unless over four feet (4') then support on each side of the coupling within eighteen inches (18") of the joint. Hangers shall not be placed on the coupling. Provide hangers adequate to maintain alignment and prevent sagging of the pipe. Make adequate provision to prevent shear or twisting of the pipe or joint.

### 3.2 INSTALLATION OF VALVES

- A. Install valves for proper operation of piping and equipment. Locate valves so as to be accessible and so that separate support can be provided when necessary.
- B. Install valves with stems pointed up in vertical position where possible, or in horizontal plane if necessary, but in no case with stems pointed downward from horizontal plane unless absolutely unavoidable.
- C. Install swing check valves in horizontal position, unless otherwise shown on the drawings, with hinge pin horizontally perpendicular to center of pipe. Install for proper direction of flow. Installations on any vertical piping must be with up flow only.

### 3.3 CLEANOUTS

- A. Size: Cleanouts of same nominal size as pipe they serve, except where they occur in piping four inches (4") and larger, in which case they shall be four inches (4") in size.
- B. Accessibility: Make all cleanouts accessible.
- C. Cleanouts - Locations:
  1. As required by Plumbing Code, where indicated on drawings and as noted. Provide cleanouts weather or not indicated on the plans or diagrams.
  2. At the upper terminal of all horizontal soil and waste lines.
  3. At ends of all soil/waste or storm drain lines more than five feet (5') in length.
  4. At one hundred feet (100') maximum intervals in horizontal straight runs on all soil/waste or storm drain line within the building lines.

5. At all horizontal offsets with an aggregate change of direction exceeding 135 degrees.
  6. At base of all soil/waste stacks and storm drain lines.
  7. At the junction between the building drain and the building sewer.
  8. For cleanouts in finished portions of building and exterior, locations subject to Owner's approval before installation.
  9. Do not locate floor and wall cleanouts in electrical rooms and elevator machine rooms.
- D. Cleanouts to Grade: Asphalt or non-surfaced areas shall be installed with a ring of concrete poured around bottom flange six inches (6") below surface. For cleanouts in non-traffic areas such as planting areas, terminate cleanout plug in concrete yard box.

### 3.4 ROOF OPENINGS

- A. Flash each pipe extending through roof with properly sized lead flashing assembly. Make watertight. Install vent caps on all vents through roof.

### 3.5 PLUMBING FIXTURES INSTALLATION

- A. Installation: Set fixtures level and in proper alignment with respect to walls and floors, and sets of fixtures equally spaced. Install supplies in proper alignment with fixtures and with each other. Install flush valves in alignment with the fixture without vertical or horizontal offsets.
- B. Seals: Seal all wall and floor mounted fixtures watertight where fixture is in contact with wall or floors. Fill all cracks and open spaces between fixtures and wall or floor with non-elastomeric sealer. Seal fixtures to wall and floor surfaces with sealant.
- C. Caulking: Caulk all deck mounted trim at the time of assembly, including fixture and casework mounted. Caulk all self-rimming sinks installed in casework.
- D. Trim: Make up trim with care and with the proper tools in order that no tool marks show after installation.
- E. Bolt carrier base supports to floor in accordance with manufacturer's installation instruction and recommendations.
- F. Water Closets and Urinals: Test and adjust all flush valves for water closets and urinals for proper flow. Bowls shall completely evacuate with a single flush. Splashing of water out of the bowl is not acceptable.
- G. Installation of emergency safety equipment (emergency showers and eyewashes): Install emergency safety equipment in conformance with ANSI Z358.1-1998. Locate identification signs in accordance with this standard. Where shut-off valves are installed in the branch line leading to emergency safety equipment, the valves shall be indicating type (OS&Y or ball valve with lever handle), labeled for identification, and locked in the open position. All exposed piping serving equipment shall be a minimum schedule 40 hot dipped galvanized steel.

**3.6 FOOD SERVICE EQUIPMENT INSTALLATION**

- A. Food Service Equipment & Fixtures: The Plumbing Contractor shall run all service lines, rough-in and make final connections to all fixtures, faucets and equipment provided by Food Service Equipment Contractor. The work shall include installing and connecting of all sinks, faucets, garbage disposals, drain lines and as required and indicated by equipment manufacturer, Plumbing Contractor shall furnish and install all tailpieces, P-traps, hot and cold water stops, gas cocks as required for Food Service furnished sinks, faucets, and equipment. The Contractor shall furnish and install sinks and equipment as indicated on plumbing drawings complete with all required trim including faucets, stops, cocks, and P-trap and strainers. The Plumbing Contractor shall also furnish and install all required vents from traps, and all required indirect waste lines.

**3.7 TESTING**

- A. Test plumbing systems in accordance with California Plumbing Code and City of San Francisco requirements.

**3.8 DOMESTIC WATER SYSTEM STERILIZATION**

- A. Close open ends of water piping each day to prevent contamination or foreign matter entering pipe during construction. Thoroughly flush out piping to remove any dirt or foreign matter.
- B. After flushing of pipe systems, sterilize entire water systems from new point or points of connection before being turned over to Owner for use. Slowly fill system with water and add chlorine chemical agent to produce a minimum of 50 ppm of chlorine in entering water.
- C. Retain treated water in pipe for a minimum of twenty-four hours. Should chlorine residual at pipe extremities be less than 50 ppm at this time, pipe shall be re-chlorinated. As an option, the water systems may be filled with a water-chlorine solution containing a minimum of 200 ppm of chlorine and allowed to stand for three hours.
- D. After chlorination, flush lines of chlorinated water and refill from domestic supply. Continue flushing until residual chlorine is not greater than the chlorine residual in the flushing water at all pipe extremities. The procedure shall be repeated if it is shown by bacteriological examination made by an approved testing agency that contamination persists in the system.
- E. Domestic water sterilization shall be performed by a licensed "qualified applicator" as required by CAL-EPA Pesticide Enforcement Branch for disinfecting and sterilizing drinking water.
- F. Submit written report to Health Department as required by State Regulations. Provide copy of report to Architect prior to completion of project.

**END OF SECTION**



**- SECTION 22 4810-****COMPRESSED AIR SYSTEMS**

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**PART 1 - GENERAL****1.1 WORK INCLUDED**

- A. Work Included in This Section: Materials, equipment, fabrication, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:
- B. Compressed air systems for hospitals, laboratories, and other usage, as indicated, including compressors, connection to existing piping, receivers, aftercoolers, dryers, regulators, filters, silencers, required and plugged outlets and connections to equipment requiring compressed air.

**1.2 REFERENCE STANDARDS**

- A. Published specifications standards, tests or recommended methods of trade, industry or governmental organizations apply to work in this section where cited below:
  - 1. NEMA - National Electrical Manufacturer's Association.
  - 2. ANSI - American National Standards Institute.
  - 3. ASME - American Society of Mechanical Engineers.
  - 4. NFPA - National Fire Protection Association.
  - 5. UL - Underwriters' Laboratories, Inc.
  - 6. UBC - Uniform Building Code.
  - 7. UMC - Uniform Mechanical Code.
  - 8. PC - Uniform Plumbing Code.
  - 9. The State of California Codes.
  - 10. Local Codes.

**1.3 QUALITY ASSURANCE**

- A. Compressed air and vacuum air systems shall be in accordance with the rules and requirements of NFPA-99.
- B. All equipment and accessories to be the product of a manufacturer regularly engaged in its manufacture.
- C. Supply all equipment and accessories new and free from defects.
- D. Supply all equipment and accessories in compliance with the applicable standards listed in Article 1.2 of this Section and with all applicable national, state and local codes.

- E. All items of a given type shall be the products of the same manufacturer.

#### 1.4 SUBMITTALS

- A. Submit the following for review:
- B. Shop drawings and product data in accordance with Section 15050.
- C. Manufacturer's installation instructions.
- D. Manufacturer's descriptive literature, operating instructions, and maintenance and repair data.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. a) Air Compressors and accessories: Ramvac.

#### 2.2 VALVES

- A. All compressed air and valves shall be specially prepared for dental service for dental area.
- B. Control Valves: 3 in. and smaller shall be one of the following:
  - 1. Bronze, rising stem split wedge, gate type, 125 psig wsp.
  - 2. Threaded ends, similar to Stockham B-106.
  - 3. For solder joint type ends: use threaded socket adapters.
- C. Check valves): 2 in. and smaller shall be one of the following:
  - 1. Threaded bronze swing type with leather or composition disc, 150 psig wsp.
  - 2. Threaded bronze spring type with composition disc and phosphor bronze spring, 150 psig wsp.
  - 3. Threaded bronze spring type with renewable bronze seat ring, stainless steel flat disc and stainless steel spring, 300 psig air pressure class.
- D. Pressure regulating valves:
  - 1. Threaded cast iron, die cast zinc, or bronze body, adjustable, direct acting single seat spring actuated diaphragm type.
  - 2. Reducing from indicated inlet pressure to indicated constant outlet pressure.
- E. Solenoid valves:
  - 1. Threaded bronze body, renewable seat, bronze or stainless steel trim and composition disc.
  - 2. Packless, normally closed, pilot piston operated type.
  - 3. Waterproofed solenoid.
  - 4. 150 psig wog.
  - 5. 120 volt, single phase.

#### COMPRESSED AIR SYSTEMS

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6. Manual bypass.
7. Provide with bronze Y strainer.
8. Equal to General Controls Type K-15.

F. SPECIALTIES

1. Filter regulator units: Threaded bronze or die cast zinc body adjustable direct acting single seat spring actuated diaphragm regulator with:
  - a. Pressure gauge.
  - b. Filter unit.
  - c. Lubricator.
  - d. Equal to Watts No. 642.
  - e. Equal to Watts No. 628.
2. Drains (Compressed Air)
3. 1/4 in. brass petcock drains in low points.
4. 1/2 in. cast iron, bronze or stainless steel mounted automatic drain traps, similar to Armstrong No. 21 where noted.

G. AIR COMPRESSORS

1. Refer to Air Compressor Schedule on drawings.
  - a. Compressors mounted on tank.
  - b. Accessories:
    - 1) Dry type inlet filters.
    - 2) Suction silencers.
    - 3) Separators with ball float valves.
    - 4) Water line strainers and flow control valves.
    - 5) Anti-siphon valve.
    - 6) Shock absorbers.
    - 7) Solenoid valves.
    - 8) Relief valves.
    - 9) Pressure switches.
    - 10) Low water cutoff switches for seal water line.
    - 11) Constant pressure valve.
    - 12) Controls: Start-stop control - below 20 hp.
    - 13) Discharge filters.
    - 14) Braided flexible copper pipe connectors.
      - a) On outlet and inlet of compressors.
      - b) On seal water connection to compressors.
  - c. Receiver:
    - 1) ASME Code stamped.
    - 2) Galvanized.
    - 3) Welded steel.
    - 4) 125 psi working pressure.
    - 5) Tested to 1-1/2 times working pressure.
    - 6) Required threaded or flanged connections.



- 7) Provide with:
  - a) Relief valve.
  - b) Gauge glass.
  - c) Automatic drain trap.
  
- H. 3 RELIEF VALVES
  - 1. Provide adjustable bronze spring type with test lever.
  - 2. Equal to Ashton No. BC.
  
- I. DEW POINT MONITOR
  - 1. Provide a dewpoint monitor consisting of a dewpoint probe, cable assembly, digital display and control, and mounting hardware.
  - 2. Monitor shall continuously display the system dewpoint in degrees [Centigrade] [Fahrenheit] with an accuracy of plus or minus 2%. Provide selection switch to display alarm set point and measured temperature. Mount monitor at eye level.
  - 3. robe shall be housed in a stainless steel frame and have a gold/aluminum oxide sensor tip. Mount probe in accordance with manufacturers instructions. Probe shall have an operating range between -70 deg C and + 70 deg C -94 deg F and +158 deg F and built for 250 psig. Provide adequate cable to connect to monitor.
  - 4. Unit shall be rated for 115V, 60 hertz, single phase. Monitor shall be microprocessor based with adjustable alarm settings and self diagnostic. Alarm shall be both audible and visual set to operate with 15 second built in time delay.
  - 5. Monitor shall be provided with a relay for connection to the master alarm panel.
  - 6. Unit shall be equal to Ohmeda Model 6801.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Piping:
  - 1. All materials and installation of systems shall conform to NFPA-99.
  - 2. Free of traps and graded to low points with drain petcocks, where inaccessible provide 1/2 in. automatic drain traps, and pipe to spill over drain.
  - 3. After welding, clean out intake piping, including wire brushing of joints and swabbing internally with wiping cloths (not cotton waste) dipped in light engine oil.
    - a. (1)Underground valves, fittings and specials (not mechanically wrapped): hand coated and wrapped with materials producing covering equal to mechanically wrapped.
  - 4. Provide ample cleanouts at changes in direction of vacuum piping.
  - 5. Hospital clinical systems: as noted under "Medical and Laboratory Gas Piping Systems."
  - 6. Threaded joints shall be made up by tinning the male thread with soft solder, with paste of litharge and glycerine applied to male threads only, or teflon tape.
  - 7. Avoid leaving any excess flux inside completed joints.
  - 8. Wash outside of piping and fittings with hot water after assembly.

9. Purge piping system until thoroughly clear with oil-free dry nitrogen or air prior to installation of alarm switches, inlets and gauge.

B. TESTS

1. Compressed Air:
  - a. Test entire system with air at rated psig.
  - b. The Medical Compressed Air System shall be tested per manufacturer's recommendations.
    - 1) Submit a letter of certification stating that all installed work and all materials used are in complete accordance with the latest codes or standards for medical systems.

**END OF SECTION**



## **- SECTION 22 4870-**

# **DENTAL VACUUM SYSTEMS**

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## **PART 1 - GENERAL**

### **1.1 SUMMARY**

- A. This section includes the following dental vacuum systems and related accessories:
  - 1. Wet vacuum systems with water injected pumps.
  - 2. Semi-wet vacuum systems with dry turbine vacuum pumps.

### **1.2 QUALITY ASSURANCE**

- A. A. Manufacturer's Qualifications: Firms regularly engaged in the manufacture of dental vacuum system equipment, of types, materials and sizes required, whose products have a record of successful in-service performance for not less than five (5) years.
- B. B Codes and Standards: Comply with the provisions of the following:
  - 1. Comply with NFPA 70 "National Electrical Code".
  - 2. Comply with NFPA 99 "Standard for Health Care Facilities".
  - 3. Comply with UL 498 "Standard for Attachment Plugs and Receptacles".
  - 4. Comply with UL 544 "Standard for Medical and Dental Equipment".
  - 5. Listing and Labeling: Provide equipment that is listed and labeled.
    - a. The Terms "Listed" and "Labeled": As defined in the "National Electrical Code," Article 100.

### **1.3 ACCEPTANCE**

- A. No work shall be done by manufacturer prior to Engineer's approval of certified shop drawings.

### **1.4 DELIVERY AND HANDLING**

- A. Deliver dental vacuum system equipment on factory-installed shipping skids, with sealing plugs in pipe ends. Handle carefully to prevent damage, breaking, denting and scoring.
- B. Manufacturer shall inform general contractor of delivery 72 hours before delivery to job site. Delivery shall be contingent upon the owner's ability to accept delivery.

## 1.5 WARRANTY

- A. Provide written warranty, signed by manufacturer agreeing to replace or repair any inadequate parts or defective materials or workmanship within one (1) year of purchase. Warranty excludes removal, reinstallation and transportation costs.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Subject to compliance with the minimum requirements listed within both the construction drawings and this specification, provide dental vacuum system equipment from one of the following:
  1. Arlan Air, Inc.
  2. Dental-Ez Mfg. Co., A Syntex Dental Co.
  3. Gast Manufacturing Corp.
  4. Prospect Air Equipment Corp.
  5. The Spencer Turbine Co.
  6. U.S. Turbine Corp.

### 2.2 DENTAL VACUUM PUMPS, GENERAL

- A. Preparation for Shipping: After assembly and testing, clean flanges and exposed machined metal surfaces and treat with an anticorrosion compound. Protect flanges and pipe openings.
- B. Motors:
  1. General: Conform to NEMA Standard MG-1, general purpose, continuous duty, Design B, single speed with type of enclosure, electrical characteristics and rpm as indicated. Motors shall have built-in thermal overload protection if available. Submittals shall state what type of protection is provided.
  2. Efficiency: NEMA efficiency label shall be provided on motor. If efficiency is not scheduled, motors shall have an efficiency equal to or higher than "average standard industry motors" in accordance with IEEE Standard 112, Test Method B.
  3. Motor Frame: NEMA Standard.
  4. Nameplate: Indicate the full identification of manufacturer, ratings, characteristics, construction and special features.
  5. Acceptable Motor Manufacturers:
    - a. Baldor
    - b. Gould
    - c. General Electric
    - d. Lincoln
    - e. Magnetek
    - f. Reliance
- C. Apply factory finish paint to assembled, tested units prior to shipping.

- D. Control Panels: Automatic control station with load control and protection functions. Comply with NEMA/ICS 2, "Industrial Control Devices, Controllers and Assemblies," UL 508, "Electrical Control Devices," and UL 544, "Medical and Dental Equipment."
1. Mounting and Wiring: Factory-installed and connected as an integral part of equipment package.
  2. Enclosure: NEMA/ICS 6, "Enclosures for Industrial Controls and Systems," Type 12 control panel, except where a higher degree of enclosure is specified.
  3. Motor Controllers: Full-voltage combination magnetic type with undervoltage release feature, motor-circuit-protector type disconnect, and short-circuit protective device.
    - a. Control Voltage: 120 volts a.c. or less, using integral control power transformer.
    - b. Motor Overload Protection: Overload relay in each phase.
    - c. Starting Devices: Hand-Off-Automatic selector switch in cover of control panel plus pilot device for automatic control as indicated.
  4. Provide for automatic alternating starting to switch lead vacuum pump.
  5. Provide for multiple vacuum pump simultaneous operation selected as "High Vac" (both pumps) and "Low Vac" (single pump).
  6. Include alarm signal device for connection to remote master alarm panels to indicate when back-up vacuum pump is operating.
  7. Include alarm signal device in Dental Office for collection tank overflow protection float to indicate tank full level before shutting off vacuum flow to dental area.

### 2.3 DRY TURBINE VACUUM PUMPS

- A. Description: Factory-assembled, tested, and packaged dry turbine vacuum pumps for semi-wet vacuum systems in dental applications. Vacuum pumps will be piped in parallel to protect against down-time (lead/lag operation) and provide added vacuum power (both pumps simultaneously) during peak operation periods.
- B. Construction: Steel sheet constructed turbine of centrifugal type, multiple-stage with the following features:
- a. Dynamically balanced impellers with 1.5 mils vibration (maximum) and clearance of not less than 1/8" throughout.
  - b. External 2" circular cooling fins for even heat dissipation.
  - c. Top mounted exhaust outlet allowing for warm air to exit, reducing heat buildup.
  - d. Continuous-duty, direct drive, sealed bearing unit requiring no lubrication.
  - e. Ambient running temperature of 104°F.
- C. Capacity: Turbine shall be rated for continuous operation and capable of 5" Hg (minimum) mercury vacuum pull at point-of-use outlet for the designated use factor noted in Appendix 'A'.
- D. Turbine Accessories: Provide the following accessories for each turbine vacuum pump:
- a. 1. Spring type floating stand for vibration isolation. Include flexible tubing on both sides of the vacuum pump.
  - b. 2. Turbine exhaust muffler with flex tube to vent pipe adapter.

## 2.4 ACCESSORIES

- A. Central Collection Tank: Fiberglass tank for use in semi-wet vacuum systems with turbine pumps and capable of 15" Hg negative pressure. Collection tank will prevent any fluids or solids, carried from the operatories, from reaching the turbines. The tank will automatically (mechanically) drain in a floor sink when the turbines turn off. Tank to include the following features.
  - 1. Automatic Overflow Protection: A float inside the tank will cut-off vacuum flow and sound an alarm in the Dental Office in the event that the tank is full.
  - 2. Tank stand for free standing tanks.
  - 3. Swing check valve on tank drain.
  - 4. Fresh water purge connection.
- B. Inlet and outlet flex pipe hook-ups for turbine vibration isolation.
- C. Inlet swing check valve for each turbine on parallel pump hook-up arrangement.
- D. Anti-Surge Vacuum Relief Valve: The vacuum relief valve protects the turbine system from overheating by allowing a constant flow of air into the vacuum lines. When the operatory vacuum lines are in use the valve closes to provide maximum suction power. When the operatory lines are not in use the valve opens, allowing cool air into the system. The valve shall be provided with a silencer.
- E. Instrumentation: Include tank vacuum gage, inlet line vacuum gage, hourmeter, and exhaust air temperature gages.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine elements and surfaces to receive work for compliance with installation tolerances and other conditions affecting performance of the dental vacuum pumps. Do not proceed with installation until unsatisfactory conditions have been corrected.

### 3.2 EQUIPMENT APPENDIXES

- A. The construction drawings specify manufacturer. If alternate manufacturer is approved during bid process, construction departments must coordinate all installation variances.

### 3.3 EQUIPMENT INSTALLATION

- A. Install individual dental vacuum pumps and receiver tank on concrete bases. Set and connect units in accordance with manufacturer's printed installation instructions. Install units plumb and level, firmly anchored, in locations indicated, and maintain manufacturers' recommended clearances. Orient so controls and devices needing servicing are accessible.
- B. Vacuum pumps and collection tank must be installed in a well ventilated mechanical room. A floor sink is required in the area of the collection tank for tank draining.

- C. Dry turbine pumps of similar horsepower should be piped in parallel.
- D. On larger (5 HP or plus) dry turbine vacuum pumps install exhaust mufflers at outlets.
- E. The dry turbine vacuum pump should not be bolted to the floor. The turbine should be installed on the spring type floating stand base provided as an accessory with the unit. Proper installation assures quiet and vibration free operation.
- F. When the dry turbine vacuum units are piped in parallel, they shall be equipped with a swing check valve for the intake connection of each turbine. The dedicated check valve will open when its turbine is operating. When the back-up turbine is not operating, its dedicated valve will be closed to prevent vacuum loss through the exhaust line.
- G. The anti-surge vacuum relief valve, provided by the manufacturer, should be installed as close to the turbine units as possible.

### 3.4 CONNECTIONS

- A. Install piping connections maintaining clearances for service and maintenance of dental vacuum pumps.
- B. All connecting vacuum lines shall be seamless copper type K or L or Schedule 40 brass. To promote the unrestricted flow of air and waste liquids through the vacuum lines, directional flow connections should be used. All fittings should be long radius sweep fittings. Care should be taken to slope the vacuum lines toward the collection tank at 1/8" per 1'-0" run, allowing waste liquids to flow with gravity, contributing to the efficiency of the vacuum system. In most cases the vacuum lines should be installed under the floor.
- C. The exhaust air vent from each turbine should be vented to the outside atmosphere. See design drawings for location. Due to the operating temperature of the system the exhaust vent pipe shall be galvanized steel.
- D. Install vacuum pressure gages on the dental vacuum collection tank and where indicated on the drawings.
- E. Install thermometers on the vacuum pump exhaust lines.
- F. Install a vacuum relief valve in the piping between the collection tank and the vacuum pump inlet. Install in accordance with the vacuum pump manufacturer's printed installation instructions.
- G. Electrical Connections: Power wiring and disconnect switches are specified in Division 16 Sections. Connect unit components to ground in accordance with the National Electrical Code and Division 16 Sections. The following electrical connections and equipment are required:
  - 1. Separate circuit for each turbine motor complete with the proper circuit breaker for the motor's power rating.
  - 2. Magnetic starter for each turbine motor, equipped with the proper thermal overload for the motor power rating.
  - 3. Control switch and running light for each turbine. Switches and running lights should be located where they will be seen and turned off at the end of a working period. An automatic time clock with an override switch for off hours use should be installed.



### 3.5 LABELING AND IDENTIFICATION

- A. Install labeling on equipment in accordance with requirements of NFPA 99.

### 3.6 COMMISSIONING

- A. Verify that the dental vacuum system equipment installations comply with manufacturer's submittal and installation requirements.
- B. Operate and adjust operating and safety controls. Replace damaged and malfunctioning controls and equipment.
- C. Checks Before Start-up: Perform the following final checks before start-up:
  - 1. Verify that specified tests of piping systems are complete.
  - 2. Check that all dental vacuum exhausts are properly located to prevent contamination of air inlets and public spaces.
  - 3. Check that all dental vacuum pump filters and discharge piping are clear.
  - 4. Check for equipment vibration control supports and flexible pipe connectors and that equipment is properly attached to substrate.
  - 5. Adjust vacuum relief valves.
  - 6. Check for water supply to the dental water injected vacuum pumps.
  - 7. Drain vacuum collection tank.
- D. Starting Procedures: Follow the manufacturer's printed procedures. If no procedures are specified by the manufacturer, proceed as follows:
  - 1. Energize circuits.
  - 2. Start and run equipment through complete sequence of operations.
  - 3. Check for excessive vibration and noise.
  - 4. Check vacuum pressures.
  - 5. Manually operate vacuum relief valves.
  - 6. Adjust operating controls including vacuum settings and automatic overflow protection float on collection tank.
  - 7. Flush with fresh water and approved non-sudsing cleaner all vacuum hose connections in dental operatories while vacuum system is running. Turn vacuum system off and verify that the collection tank drains properly.

### 3.7 ADJUSTING AND CLEANING

- A. Inspect exposed finish after completing system installation, including pipe connections, fittings, valves and specialties. Remove burrs, dirt and construction debris, and repair damaged finishes, including chips, scratches and abrasions with touch-up paint.

**END OF SECTION**

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**- SECTION 23 0593 -****TESTING, ADJUSTING AND BALANCING**

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**PART 1 - GENERAL****1.1 SUMMARY**

- A. Work Included: Materials, equipment and labor required for testing, adjusting, and balancing work required by this Section, including air, and associated equipment and apparatus. The work consists of setting speed and volume (flow) adjustments, recording data, conducting tests, preparing and submitting reports, and recommending modifications to work as required.

**1.2 QUALIFICATIONS**

- A. Perform work of this Section by a firm certified by National Environmental Balancing Bureau (NEBB) or Associated Air Balance Council (AABC).
- B. Do work of this Section under the direct supervision of a person who has passed written and practical NEBB or AABC examinations for testing, adjusting, and balancing of air systems.

**1.3 QUALITY ASSURANCE**

- A. Codes and Standards:
  - 1. NEBB Compliance: Comply with NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" as applicable to mechanical air distribution systems, and associated equipment and apparatus; or comply with AABC's Manual MN-1, "AABC National Standards," as applicable to mechanical air distribution systems, and associated equipment and apparatus.
  - 2. Industry Standards: Comply with ASHRAE recommendations pertaining to measurements, instruments, and testing, adjusting and balancing, except as otherwise indicated.

**1.4 SUBMITTALS**

- A. Procedures: Submit certified test reports, signed by Test and Balance (TAB) supervisor who performed TAB work.
- B. Report Forms:
  - 1. Submit copies of report forms to Architect within 30 days of award of the Contract by Owner prior to commencement of testing and balancing work at the site.
  - 2. Provide 8-1/2- by 11-inch paper for looseleaf binding, with blanks for listing the required test ratings and for certification of report.

3. Submit reports on forms similar in content to standard AABC or NEBB test forms.
  4. Submit final test and balance report. Include Record Drawings with terminal codes for cross-reference with the Submittal, such that terminals referenced in the Submittal are easily located on the Drawings.
  5. Include identification and types of instruments used, and their most recent calibration date.
  6. Submit resume data on person who is to directly supervise testing, adjusting and balancing work.
- C. Maintenance Data: Include copies of balancing report and identification of instruments in maintenance manuals.
- D. NEBB or AABC Certificate: At time of submittal of forms, submit NEBB or AABC certification form for review.

## **PART 2 - PRODUCTS**

### **2.1 INSTRUMENTS**

- A. Utilize test instruments and equipment as recommended in the following:
1. NEBB's Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems.
  2. AABC's Manual MN-1, "AABC National Standards."

## **PART 3 - EXECUTION**

### **3.1 VERIFICATION OF CONDITIONS**

- A. Do not proceed with testing, adjusting and balancing work until construction of relevant systems has been completed and is operable. Do not proceed until all systems scheduled for testing, adjusting and balancing are clean and free from debris, dirt and discarded building materials.
- B. Verify the following:
1. Equipment is operable and in a safe and normal condition.
  2. Temperature control systems are installed complete and operable.
  3. Final filters are clean and in place.
  4. Duct systems are clean of debris.
  5. Fan rotation is correct.
  6. Dampers are in place and open.
  7. Access doors are closed.
  8. Air outlets are installed and connected.
  9. Service and balance valves are open.
  10. Any conditions affecting system operation, such as open doors, adjacent pressurized areas, and the like, are in final operating conditions prior to testing and balancing.

- C. Report any defects or deficiencies noted during performance of services to Architect. Promptly report abnormal conditions in Mechanical Systems or conditions which prevent system balance.
- D. Automatic Temperature Control Systems:
  - 1. Set and adjust automatically operated devices to achieve required sequence of operations. Coordinate with the automatic temperature control supplier. Do not proceed without his representation.
  - 2. Verify controls for proper calibration and correct as necessary.

### **3.2 AIR SYSTEM PROCEDURE**

- A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities.
- B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.
- C. Measure air quantities at air inlets and outlets. Log shall show each successive test.
- D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.
- E. Use volume control devices to regulate air quantities only to the extent that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.
- F. Vary total system air quantities by adjustment of fan speeds. Vary branch air quantities by damper regulation.
- G. Adjust fans to deliver within 5 percent of specified flow. Adjust air outlets and inlets to within 10 percent of specified flow.
- H. Adjust outside air to all fans as scheduled. Measure outside air for variable air volume fans at full flow and with all terminal units at minimum flow. Set outside air damper with terminal units at minimum airflow.

### **3.3 AIR MOVING EQUIPMENT TESTING**

- A. Location.
- B. Manufacturer.
- C. Model.
- D. Supply airflow, specified and actual.
- E. Return airflow, specified and actual.
- F. Outside airflow, specified and actual.
- G. Total external static pressure, specified and actual.

- H. Inlet pressure.
- I. Discharge pressure.
- J. Fan RPM.

**3.4 EXHAUST FAN TESTING**

- A. Location
- B. Manufacturer.
- C. Model.
- D. Airflow, specified and actual.
- E. Total external static pressure, specified and actual.
- F. Inlet pressure.
- G. Discharge pressure.
- H. Fan RPM.

**3.5 RETURN AIR/OUTSIDE AIR TESTING**

- A. Identification/location.
- B. Design airflow.
- C. Actual airflow.
- D. Design return airflow.
- E. Actual return airflow.
- F. Design outside airflow.
- G. Actual outside airflow.
- H. Return air temperature.
- I. Outside air temperature.
- J. Required mixed air temperature.
- K. Actual mixed air temperature.
- L. Design outside/return air ratio.
- M. Actual outside/return air ratio.

**TESTING, ADJUSTING AND BALANCING**

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**3.6 ELECTRIC MOTORS TESTING**

- A. Manufacturer.
- B. HP/BHP.
- C. Phase, voltage, amperage; nameplate, actual, no load. Record voltage and amperage on all phases of 3 phase motors.
- D. RPM.
- E. Service factor.
- F. Starter size, rating, heater elements.

**3.7 V-BELT DRIVES TESTING**

- A. Identification/location.
- B. Required driven RPM.
- C. Driven sheave, diameter and RPM.
- D. Belt, size and quantity.
- E. Motor sheave, diameter and RPM.

**3.8 DUCT TRAVERSE TESTING**

- A. System zone/branch.
- B. Duct size.
- C. Area.
- D. Design velocity.
- E. Design airflow.
- F. Test velocity.
- G. Test airflow.
- H. Duct static pressure.
- I. Air temperature.
- J. Air correction factor.



**3.9 AIR DISTRIBUTION TESTING**

- A. Air terminal number.
- B. Room number/location.
- C. Terminal type.
- D. Terminal size.
- E. Design velocity.
- F. Design airflow.
- G. Test (final) velocity.
- H. Test (final) airflow.
- I. Percent of design airflow.

**3.10 REFRIGERANT COOLING COIL TESTING**

- A. Identification/number.
- B. Location.
- C. Service.
- D. Manufacturer.
- E. Airflow, design and actual.
- F. Entering air DB temperature, design and actual.
- G. Entering air WB temperature, design and actual.
- H. Leaving air DB temperature, design and actual.
- I. Leaving air WB temperature, design and actual.
- J. Air pressure drop, design and actual.

**3.11 REFRIGERANT SYSTEM CONDENSING UNIT**

- A. Ambient temperature.
- B. Head pressure.
- C. Suction pressure.

- D. Compressor electrical data, phase, voltage, amperage; nameplate, actual, no load. Record voltage and amperage on all phases of 3 phase motors.
- E. Copy of unit manufacturer's test start-up, test report.

**3.12 ADJUSTING**

- A. Recorded data shall represent actually measured or observed conditions. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops. Adjust air systems to deliver specified volumes with lowest possible fan speed.

**3.13 DOMESTIC WATER**

- A. Adjust domestic water recirculation system to ensure hot water circulation in all mains.

**- END OF SECTION -**

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**- SECTION 23 0800 -**

**COMMISSIONING OF HVAC SYSTEMS**

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**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes:
  - 1. Requirements for commissioning the HVAC system and its subsystems and equipment. This Section supplements the general requirements specified in Section 01 91 00 – Commissioning.
- B. Specific commissioning requirements are given in the following sections of these specifications.
  - 1. Section 01 91 00 – Commissioning.
  - 2. Section 26 08 00 – Commissioning of Electrical Systems.

**1.2 SUBMITTALS**

- A. General:
  - 1. Comply with Section – Submittal Procedures.
  - 2. See submittal requirements in Section 01 91 00 – Commissioning.
- B. Prior to functional testing:
  - 1. Completed prefunctional checklists.
- C. Provide all proposed tests during the submittal phase of construction for approval to the CP.

**1.3 COORDINATION**

- A. The Contractor shall coordinate all testing and balancing and major equipment startup and installation with the Commissioning Provider (CP).
- B. For the primary HVAC equipment, the Controls Contractor shall provide a short discussion of the control of the equipment during the mechanical or electrical training conducted by others.

## **PART 2 - PRODUCTS**

### **2.1 TEST EQUIPMENT**

- A. All standard testing equipment required to perform startup and initial checkout and required functional performance testing shall be provided by the Trade Contractor for the equipment being tested.
- B. Datalogging equipment or software required to test equipment will be provided by the CP ,if required, but shall not become the property of the Owner.
- C. All testing equipment shall be of sufficient quality and accuracy to test or measure system performance required by the Contract Documents.

## **PART 3 - EXECUTION**

### **3.1 TESTING PREPARATION**

- A. General procedures are described in Section 01 91 00 – Commissioning.
- B. Prefunctional Checklists:
  - 1. Contractor develop, fill out and sign prefunctional checklists for the following equipment and systems:
    - a. Boilers
    - b. DWH
    - c. Pumps
    - d. Hydronic distribution system
    - e. Radiators.
    - f. Ductwork.
    - g. Exhaust Fans.
    - h. VFDs
    - i. Rooftop Packaged Units.
    - j. Exhaust Hoods/Speciality Fans.
    - k. TAB.
    - l. HVAC Controls.
    - m. Fire and smoke dampers.
    - n. Equipment vibration control.
- C. Prerequisites for Testing:
  - 1. Contractor shall certify that HVAC systems, subsystems, and equipment are completed, calibrated, and started.
  - 2. Contractor shall certify that air and water TAB has been completed with discrepancies and problems resolved.

3. Contractor shall certify that HVAC instrumentation and control systems have been completed and calibrated; are operating according to the Contract Documents.

### 3.2 TESTING

- A. General procedures are described in the Division 01 Section "General Commissioning Requirements."
- B. Contractor shall perform all pre-functional performance tests with the tests approved by the Commissioning Provider. The CP and the owner shall be advised of all tests as required by the general commissioning requirements in 01 91 00.
- C. Contractor shall assist in performing all following functional performance tests conducted by the Commissioning Provider.
- D. The details of the functional performance tests shall be reviewed and refined during the construction phase by the Commissioning Provider. The final test will be provided to the contractor at least 5 business days before the test is conducted.

**- END OF SECTION -**



**- SECTION 23 2113 -****HYDRONIC PIPING SYSTEMS**

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**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 23 2113 HYDRONIC PIPING SYSTEMS**

- A. Design Standard - Design and specify work to include materials, installation, and testing of pipes and pipe fittings for cooling tower water, chilled water, building heating water, make-up and drain and valves for a complete and operable system.
1. Manual vents are standard but automatic vents can be considered in special situations. Where vent location is high or otherwise inaccessible, the following procedure can be followed: Install valve at vent chamber, then extend 0.375-in. tubing to the nearest janitor sink or mechanical room floor drain and terminate with a ball valve. Use automatic water feed set to maintain proper system pressure. Add cold water make-up at the air vent line above an air-eliminating device.
  2. Provisions shall be made for draining and air venting of all water coils.
- B. Chilled Water:
1. Pipe Sizes 2-1/2" and larger: Steel, Schedule 40 with welded or mechanical coupling fittings, copper tubing, Type "L".
  2. Pipe Sizes 2" and Smaller: Steel, Schedule 40 with threaded fittings, copper tubing, Type "L".
  3. Drain Pipe: Steel, Schedule 40, threaded fittings, copper tubing, Type "M", soldered fittings.
- B. Heating Water:
1. Pipe Sizes 2-1/2" and larger: Steel, Schedule 40 with welded fittings, copper tubing, Type "L".
  2. Pipe Sizes 2" and Smaller: Steel, Schedule 40 with threaded fittings, copper tubing, Type "L".
  3. Drain Pipe: Steel, Schedule 40, threaded fittings, copper tubing, Type "M", soldered fittings.
- C. Cooling Water:
1. Pipe Sizes 2-1/2" and larger: Steel, Schedule 40 with welded, flanged, or mechanical coupling fittings.



2. Pipe Sizes 2" and Smaller: Steel, Schedule 40 with threaded fittings, copper tubing, Type "L".
- D. Pressurized Steel Pipe:
1. ASTM A-53-84a, Electric Resistance Welded or Seamless, Grade B: Black, unless otherwise indicated, schedule as specified.
  2. ASTM A-135-84, Schedule B: Black unless otherwise specified, schedule as specified.
- E. Manual air vent valves:
1. Operated manually with screwdriver or thumbscrew, 1/8" NPS or 1/4" NPS connection as required.
  2. Approved Manufacturers:
    - a. Armstrong
    - b. Bell and Gossett
    - c. Hoffman
    - d. Spirax
    - e. Sarco
- F. Automatic air vent valves:
1. Float type with pressure rating equal to or greater than the system in which it is installed.
  2. Approved Manufacturers:
    - a. Taco
    - b. Bell and Gossett
    - c. Hoffman
- G. Automatic flow control valves:
1. General: Constructed to provide constant flow over a range of differential pressures, with field adjustable control point.
  2. Accuracy: Plus or minus 5 percent.
  3. Flow Characteristic: Smooth, continuous curve, void of abrupt changes over the entire range of operation.
  4. Construction: Brass body, EPDM O-ring seals, abrasion resistant and non-corrosive thermoplastic cartridge, 1/8" pressure ports.
  5. Flow adjustment: External adjustment via removable key and numeric dial indicator. Indicator reading to match manufacturer's data chart for calibration and flow reading.
  6. Pressure/Temperature Rating: 230 PSIG/248F.
  7. Approved Manufacturers:
    - a. Taco
    - b. Bell and Gossett
    - c. Hoffman
- H. Strainers:
1. Full line size strainers with ends matching connecting piping materials, machined screen seats, gasketed cap, blow off outlet, minimum 2-1/2 to 1 open area ratio, and Type 304 stainless steel screens with 1/16" diameter holes.

2. Approved Manufacturers:
  - a. Mueller
  - b. Armstrong
  - c. Hoffman
  - d. Wheatley
  - e. Victaulic (where mechanical couplings are allowed)

H. Air Separators:

1. Line size, pressure rated for 125 PSI. Construct sizes 1-1/2" and smaller of cast iron, and sizes 2" and larger of steel complying with ASME Boiler and Pressure Code and stamped with the "U" symbol.
2. Approved Manufacturers:
  - a. Amtrol
  - b. Armstrong
  - c. Bell and Gossett
  - d. Taco
  - e. Wheatley

I. Expansion Tanks:

1. Welded steel, constructed, tested and stamped in accordance with Section VIII f ASME Boiler and Pressure Vessel Code for working pressure of 125 PSI. Furnish National Board Form U-1 denoting compliance. Support vertical tanks with steel legs or base. Provide single flexible diaphragm securely sealed into tank to separate air charge from system water, to maintain design expansion capacity. Provide pressure gage and air-charging fitting, and drain fitting. Diaphragm: Removable and replaceable in line.
2. Approved Manufacturers:
  - a. Mueller
  - b. Amtrol
  - c. Armstrong
  - d. Taco
  - e. Bell and Gossett

J. Liquid flow switches:

1. Brass for all wetted parts, with packless construction, paddle with removable segments for pipe size and flow velocity, vapor-proof electrical compartment for switches mounted on cold hydronic piping systems, switches for 115V, 60HZ, 1-phase, with 7.4 A rating.
2. Approved Manufacturers:
  - a. McDonnell and Miller
  - b. Dwyer

K. Water pressure relief valves:

1. Size and capacity as selected by installer for proper relieving capacity, in accordance with ASME Boiler and Pressure Vessel Code.
2. Combined Pressure-Temperature Relief Valves: Bronze body, test lever, thermostat, complying with ANSI Z21.22 listing requirements for temperature discharge capacity. Provide temperature relief at 210F and pressure relief at 125 PSI.

3. Pressure Relief Valves: Bronze body, test lever, ASME rated. Provide pressure relief at 30 PSI.
  4. Approved Manufacturers:
    - a.
    - b. Amtrol
    - c. Bell and Gossett
    - d. Spirax Sarco
    - e. Watts Regulator
- L. Thermometers:
1. 3" diameter bimetal dial thermometer, stainless steel case, white dial, black numbers, 4" stainless steel stem, brass separable socket. Back or bottom connections as required.
  2. Service Range
  3. Heating Water 50 to 300F
  4. Chilled Water 0 to 120F
  5. Condenser Water 50 to 150F
  6. Approved Manufacturers:
    - a. Amtrol
    - b. Armstrong Pumps
    - c. Bell and Gossett
    - d. Taco
- M. Thermometer Wells:
1. Brass or stainless steel, pressure rated to match piping system design pressure. Provide extensions for insulated piping of length required to extend above insulation at each location. Provide cap nut with chain fastened permanently to thermometer well.
  2. Approved Manufacturers:
    - a. Ashcroft
    - b. Terice
    - c. Weiss
- N. Pressure Gages:
1. Type: General use, 1 percent accuracy, ANSI B40.1, Grade A, phosphor bronze bourdon type, bottom connection.
  2. Case: Drawn steel or brass, glass lens, 4-1/2" diameter.
  3. Connector: Brass with 1/4" male NPT.
  4. Scale: White coated aluminum, with permanently etched markings.
  5. Range:
  6. Pump Suctions: 30" Hg – 60 PSI
  7. Water: 0-100 PSI
  8. Approved Manufacturers:
    - a. Amtek/US Gauge
    - b. Ashcroft, Palmer
    - c. Marshalltown Instruments
    - d. Terice
    - e. Weiss

## f. Weksler

## O. Differential Pressure Switches:

1. Sensing Range: 0 – 1.0" water column. Diaphragm operated with switching accomplished by photocell controlled relays, adjustable switch setpoints that close contacts on the relay if the differential pressure sensed raised above the setpoint, incorporate a pointer type gage with divisions of 0.02" W.C.

## P. Instrument Probe Fittings:

1. Brass or stainless steel body and cap, high pressure rated, valve material neoprene, Nordan or Viton to suit temperature range, 1/4" or 1/2" NPT tailpiece.

## Q. Expansion Joints:

1. Furnish and install controlled flexing expansion joints where shown or required. Expansion Joints: Minimum of 150 PSI working pressure.
2. For copper piping, 3/4" through 3" inches, use Type HB, 1-3/4" traverse two-ply stainless steel bellows, traveling nipple extended through bellows and guided each end, integral shroud, screwed steel ends.
3. For steel piping, 1-1/2" through 8" externally pressurized. 4" traverse, 150 PSI working pressure, stainless steel bellows, 150 PSI flanged ends, furnish insulation shroud.
4. Approved Manufacturers:
  - a. Flexonics
  - b. Mason Industries
  - c. Amber-Bush
  - d. Metraflex

## R. Pipe Guides:

1. Install where using expansion joints to avoid pipe buckling.
2. Approved Manufacturers:
  - a. Flexonics
  - b. Mason Industries
  - c. Amber Bush
  - d. Metraflex

## S. Pipe Anchors:

1. Install where using expansion joints to avoid pipe displacement.
2. Approved Manufacturers:
  - a. Flexonics
  - b. Mason Industries
  - c. Amber-Bush
  - d. Metraflex

**1.3 SUMMARY**

- A. This Section includes piping material and accessories for all HVAC piping.

**1.4 SUBMITTALS**

- A. General: Submit in accordance with Section 01300.
- B. Product Data: Submit product data for pipe material and accessories.
- C. Closeout Submittals:
  - 1. Submit under provisions of Section 01700.
  - 2. Warranty: Submit specified warranty.

**1.5 WARRANTY**

- A. Comply with provisions of Section 01740.

**- END OF SECTION -**

**- SECTION 23 2123.16 -****BASE MOUNTED, END-SUCTION PUMPS**

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**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 SECTION 23 2123.16 - PUMPS – BASE MOUNTED, END SUCTION:**

- A. Pumps shall be electric-motor-driven, centrifugal, single-suction, single-stage pumps. Pumps shall be bronze fitted, with bronze impeller, with close-grained semi-steel vertically split casing (125 PSI), provided with mechanical seals designed for the operating conditions shown on the plans. Pumps shall be provided with sleeve bearings and an oil reservoir. A drop-out coupling shall be provided.
- B. Pumps shall have a sleeve bearing, specially selected for quiet operation at 1750 RPM. The motor size shown on the drawing shall be the minimum acceptable. A pump motor should operate within the service factor of the motor, providing that the service factor is acceptable to the pump manufacturer. The motor shall not exceed the nominal HP at the specified delivery and head.
- C. Discharge increasers shall be concentric and located at the pump discharge nozzle. Suction pipe reducers shall be eccentric, located at the pump suction nozzle and at least five diameters of straight pipe shall be installed before the inlet or along the sweep elbow. (Suction diffusers in lieu of straight pipe section may be used.) A 0.75" drain shall be provided from each base plate to the nearest floor drain.
- D. Pumps shall be selected so that the ratio of impeller diameter to the maximum diameter possible in the casing shall not exceed 0.85. A purge cock shall be provided in the casing and gage tappings shall be provided in pump suction and discharge.
- E. All piping connections to pump shall be supported independently so that no strain is imposed on the pump casing.
- F. Pumps installed on "slab-on grade" shall be mounted on a 6" high concrete pad with anchor bolts. The space between pad and base shall be grouted to eliminate all voids.
- G. Pumps shall have rear pull-out design for removal of the impeller without disturbing the motor alignment or piping.

- H. Pumps installed on supported slabs shall be provided with concrete inertia subbases with spring isolators.
- I. Acceptable Manufacturers:
  - 1. Bell and Gossett
  - 2. Taco
  - 3. Paco

**1.3 SUMMARY**

- A. This Section includes information on base mounted pumps for hot water, chilled water and condenser water systems.

**1.4 SUBMITTALS**

- A. General: Submit in accordance with Section 01300.
- B. Closeout Submittals:
  - 1. Submit under provisions of Section 01700.
  - 2. Warranty: Submit specified warranty.

**- END OF SECTION -**

**- SECTION 23 2123 -****HYDRONIC PUMPS**

---

**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 23 2123 HYDRONIC PUMPS:**

- A. Design Standard - Design and specify work to include materials, installation, and testing of pumps for a complete and operable system.
- B. General:
  - 1. Factory-tested pumps cleaned and painted with enamel prior to shipment.
  - 2. All pumps shall have bronze impellers.
  - 3. A single gage shall be connected to the discharge and suction side of each pump and across the strainer so that the differential pressure can be observed.
- C. Pumps – Closed Coupled:
  - 1. Closed-coupled pumps are not permitted over 0.5 HP.
- D. Pumps – Base Mounted, End Suction:
  - 1. Pumps shall be electric-motor-driven, centrifugal, single-suction, single-stage pumps. Pumps shall be bronze fitted, with bronze impeller, with close-grained semi-steel vertically split casing (125 PSI), provided with mechanical seals designed for the operating conditions shown on the plans. Pumps shall be provided with sleeve bearings and an oil reservoir. A drop-out coupling shall be provided.
  - 2. Pumps shall have a sleeve bearing, specially selected for quiet operation at 1750 RPM. The motor size shown on the drawing shall be the minimum acceptable. A pump motor should operate within the service factor of the motor, providing that the service factor is acceptable to the pump manufacturer. The motor shall not exceed the nominal HP at the specified delivery and head.
  - 3. Discharge increasers shall be concentric and located at the pump discharge nozzle. Suction pipe reducers shall be eccentric, located at the pump suction nozzle and at least five diameters of straight pipe shall be installed before the inlet or along the sweep elbow. (Suction diffusers in lieu of straight pipe section may be used.) A 0.75" drain shall be provided from each base plate to the nearest floor drain.
  - 4. Pumps shall be selected so that the ratio of impeller diameter to the maximum diameter possible in the casing shall not exceed 0.85. A purge cock shall be provided in the casing and gage tappings shall be provided in pump suction and discharge.



5. All piping connections to pump shall be supported independently so that no strain is imposed on the pump casing.
6. Pumps installed on "slab-on grade" shall be mounted on a 6" high concrete pad with anchor bolts. The space between pad and base shall be grouted to eliminate all voids.
7. Pumps shall have rear pull-out design for removal of the impeller without disturbing the motor alignment or piping.
8. Pumps installed on supported slabs shall be provided with concrete inertia subbases with spring isolators.

E. In-Line Pumps:

1. Pumps shall be centrifugal and single-stage, complete with motor, mechanical seals, bronze fittings, bronze impellers, and a flexible coupler with safety guard. The pumps shall also be dynamically and hydraulically balanced.
2. The pump motor shall be supported independently.

F. Approved Manufacturers:

1. Pumps – Base Mounted, End Suction:
  - a. Bell and Gossett
  - b. Taco
  - c. Paco
2. In-Line Pumps:
  - a. Bell and Gossett
  - b. Taco
  - c. Paco

G. Substitutes Allowed:

1. Yes, if performance and quality equivalency can be evidenced.

H. Associated Design Standards and Construction Specifications:

1. 23 05 10 – HVAC Piping Design Standards
2. 23 05 53 – Identification for HVAC Piping and Equipment Design Standards
3. 23 21 05 – Hydronic Piping Systems Design Standards

### 1.3 SUMMARY

- A. This Section includes all pumps for hydronic pumps, chilled water pumps and condenser water pumps.

### 1.4 SUBMITTALS

- A. General: Submit in accordance with Section 01300.
- B. Closeout Submittals:
1. Submit under provisions of Section 01700.
  2. Warranty: Submit specified warranty.

## HYDRONIC PUMPS

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**1.5 WARRANTY**

- A. Comply with provisions of Section 01740.

**- END OF SECTION -**



**- SECTION 23 2513 -****CLOSED LOOP WATER TREATMENT**

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**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 SECTION 23 2513 - CLOSED LOOP WATER TREATMENT:**

- A. General: All new hot water and chilled water systems that are independent of the central systems shall be arranged for shot feed chemical treatment. In each such system, the equivalent of one Calgon 100L Micromet pot feeder shall be provided, including pressure gage and flow indicator. The pot feeder to the system shall be hard piped; using a hose is NOT acceptable.
- B. After all items of equipment have been connected to the system, the hot and chilled water system shall be chemically cleaned as follows:
  - 1. Drain and refill the system using tri-sodium phosphate, 1 lb for every 50-gallon in the system.
  - 2. Fill, vent and circulate the system with this solution, allowing it to reach design or operating temperatures.
  - 3. After circulating a few hours, the system should be drained completely, strainers removed and cleaned, dirt legs and pockets opened and cleaned, and then refilled with fresh water.
  - 4. Reduced pressure principal backflow preventers shall be installed on all make-up water lines. Drains shall be piped to the nearest floor drain.

**1.3 SUMMARY**

- A. This Section includes provisions for Closed Loop Water Treatment Systems.

**1.4 SUBMITTALS**

- A. General: Submit in accordance with Section 01300.
- B. Closeout Submittals:
  - 1. Submit under provisions of Section 01700.
  - 2. Warranty: Submit specified warranty.

**1.5 WARRANTY**

- A. Comply with provisions of Section 01740.

**- END OF SECTION -**

## **- SECTION 23 2516 -**

# **OPEN TOWER WATER TREATMENT**

---

## **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 SECTION 23 2516 - OPEN TOWER WATER TREATMENT:**

- A. General: All new open loop cooling tower systems shall be provided with a non-chemical treatment system similar to the EnviroTower system, or Dolphin system.
- B. After all items of equipment have been connected to the system, the hot and chilled water system shall be chemically cleaned as follows:
  - 1. Drain and refill the system using tri-sodium phosphate, 1 lb for every 50-gallon in the system.
  - 2. Fill, vent and circulate the system with this solution, allowing it to reach design or operating temperatures.
  - 3. After circulating a few hours, the system should be drained completely, strainers removed and cleaned, dirt legs and pockets opened and cleaned, and then refilled with fresh water.
  - 4. Reduced pressure principal backflow preventers shall be installed on all make-up water lines. Drains shall be piped to the nearest floor drain.

### **1.3 SUMMARY**

- A. This Section includes information on the Open Tower Water Treatment.

### **1.4 SUBMITTALS**

- A. General: Submit in accordance with Section 01300.
- B. Closeout Submittals:
  - 1. Submit under provisions of Section 01700.
  - 2. Warranty: Submit specified warranty.

**1.5 WARRANTY**

- A. Comply with provisions of Section 01740.

**- END OF SECTION -**

**- SECTION 23 3000 -**

**DUCTWORK ACCESSORIES**

---

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 23 30 00 DUCTWORK AND ACCESSORIES:**

- A. **A.** General: Design and specify work to include materials, installation, and testing of HVAC duct accessories, such as volume dampers, splitter dampers, adjustable deflectors, duct access doors, backdraft dampers, fire dampers, duct silencers, spin fittings, and smoke damper:

**1.3 SUMMARY**

- A. This Section includes all ductwork accessories. For more detail, see sections 23 3313.13, 23 3313.16 and 23 3313.23.

**1.4 SUBMITTALS**

- A. General: Submit in accordance with Section 01300.
- B. Closeout Submittals:
  - 1. Submit under provisions of Section 01700.
  - 2. Warranty: Submit specified warranty.

**1.5 WARRANTY**

- A. Comply with provisions of Section 01740.

**- END OF SECTION -**





**- SECTION 23 3100 -****HVAC DUCTS AND CASINGS**

---

**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 23 3100 HVAC DUCTS AND CASINGS:**

- A. Design Standard:
1. General: Design and specify work to include materials, installation, and testing of HVAC ductwork and accessories, including the following:
    - a. Heating and air conditioning supply and return systems
    - b. Outside air systems
    - c. Exhaust systems
    - d. Ductwork hangers (23 0529)
    - e. Plenums (23 3200)
    - f. Gas Vents (23 5123)
  2. Galvanized Steel Ductwork: Carbon steel, lock-forming quality, hot-dip galvanized, with spangle type zinc coating, double seam without showing fracture. Conform to ASTM A525 and A527.
  3. ASHRAE and/or SMACNA shall be used as a guide.
  4. Design medium pressure ductwork at 0.1"/100' pressure drop.
  5. Design low pressure ductwork at 0.08"/100' Pressure classification shall be specified on the drawings.
  6. All metal ductwork shall be cross broken to ensure rigidity.
  7. Inlet and discharge ductwork configuration shall conform to the SMACNA HVAC Duct Design Manual.
  8. Seismic restraints shall be designed per SMACNA requirements.
  9. All ductwork located outdoors shall be designed to be waterproof and sloped for water run-off.

**1.3 SUMMARY**

- A. This Section includes general information on the design and installation of ductwork for HVAC systems.

**1.4 SUBMITTALS**

- A. General: Submit in accordance with Section 01300.
- B. Closeout Submittals:
  - 1. Submit under provisions of Section 01700.
  - 2. Warranty: Submit specified warranty.

**1.5 WARRANTY**

- A. Comply with provisions of Section 01740.

**- END OF SECTION -**

**- SECTION 23 3116 -****NON-METAL DUCTS**

---

**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 SECTION 23 3116 – NON-METAL DUCTS:**

- A. Flexible Ducts:
1. Standard factory fabricated product, construct an inner wall of impervious vinyl or chlorinated polyethylene, permanently bonded to a vinyl or zinc-coated spring steel helix. Cover the assembly with fiberglass blanket insulation covered by an outer wall of vinyl or fiberglass-reinforced metalized vapor barrier. UL 181 listed Class 1 flexible air duct material. Overall thermal transmission no more than 0.25 (BTU/in)/(hr/sq. ft./deg. F) at 75F differential, per ASTM C335. Vapor transmission value no more than 0.10 perm, per ASTM E96. Rated for a minimum of 4" w.g. positive pressure and 1" w.g. negative pressure. Air friction correction factor of 1.3 maximum at 1000 FPM. Working air velocity of at least 2000 FPM. Flame spread rating no more than 25. Smoke development rating no more than 50 as tested per ASTM E84. Must have cataloged data on insertion loss characteristics, minimum attenuation of 29 DB for 10' straight length at 8" diameter and 500 Hz.
  2. Install flexible duct with bend radius equal to 1.5 times the diameter. Minimum length 2'. Maximum length 5'.
  3. Provide round neck grilles/diffusers or square to round transitions. No flex duct connections directly to square neck allowed.
  4. Flex duct allowed only for vertical drops to diffusers. Maximum offset angle from vertical: 30 degrees.
  5. Approved for use on supply, and return ducts only; not allowed for return or exhaust.
  6. Flex duct allowed in concealed spaces above lay-in ceilings only.
  7. Approved Manufacturers:
    - a. JP Lamborn Co.
    - b. Norflex
    - c. Clevaflex
    - d. Casco
    - e. Atco
    - f. Flexmaster
    - g. Thermaflex

**1.3 SUMMARY**

- A. This Section includes information on flex ductwork to be used for the last 6' to the register.

**1.4 SUBMITTALS**

- A. General: Submit in accordance with Section 01300.
- B. Closeout Submittals:
  - 1. Submit under provisions of Section 01700.
  - 2. Warranty: Submit specified warranty.

**1.5 WARRANTY**

- A. Comply with provisions of Section 01740.

**- END OF SECTION -**

**- SECTION 23 3313.13 -****DAMPERS**

---

**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 SECTION 23 33 13.13 - DAMPERS:**

- A. Control Dampers:
1. Provide automatic control dampers as indicated. Airfoil, multi-blade type, maximum blade length of 48". Provide parallel blades for positive or modulating mixing service and opposed blades for throttling service.
  2. Blades to be interlocking, minimum 16 gauge galvanized steel. Damper blades reinforced, have continuous full length axle shafts and/or operating jackshafts as required to provide coordinated tracking of blades. Dampers over 25 sq. ft. in area to be in two or more section, with interconnecting blades. Dampers to have a maximum air leakage of 15 CFM psf at 4-inch w.g. pressure. Provide automatic dampers except those specified with units.
  3. Acceptable Manufacturers:
    - a. Ruskin
    - b. Greenheck
    - c. Penn
    - d. Nailor
    - e. Cesco
- B. Volume Dampers:
1. Construct of galvanized sheets not lighter than 18 gauge, reinforced to prevent vibration, equipped at both ends with brass bearing mounts and of sufficient length to provide a complete shut off of the duct.
  2. Provide each damper with an adjustment and locking quadrant device for accessible locations, or remote type for non-accessible locations. Provide operating rod and attaching devices as required. Provide raised platform for insulated duct.
  3. Acceptable Manufacturers:
    - a. Ruskin
    - b. Greenheck
    - c. Penn

- d. Nailor
- e. Cesco

C. Barometric Dampers:

- 1. Frame and blades fabricated from 0.063 mill finish aluminum. Blades have polyurethane edge seals. ½ inch diameter aluminum blade shafts with bronze bearings. Adjustable counterweight. Blades start to open at 0.05" ADP -55 FPM. Blades fully open at 0.06" ADP – 680 FPM.
- 2. Acceptable Manufacturers:
  - a. Ruskin
  - b. Greenheck
  - c. Penn
  - d. Nailor
  - e. Cesco

**1.3 SUMMARY**

- A. This Section includes details on control dampers, volume dampers and barometric dampers.

**1.4 SUBMITTALS**

- A. General: Submit in accordance with Section 01300.
- B. Closeout Submittals:
  - 1. Submit under provisions of Section 01700.
  - 2. Warranty: Submit specified warranty.

**1.5 WARRANTY**

- A. Comply with provisions of Section 01740.

**- END OF SECTION -**

## **- SECTION 23 3313.16 -**

# **FIRE/SMOKE DAMPERS**

---

## **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 SECTION 23 33 13.16 - FIRE/SMOKE DAMPERS:**

- A. Motorized fire/smoke damper with motor. 22 gauge roll from galvanized steel with a 120 VAC motor for motorized operation. Standard UL 212F fusible link. Provide a smoke detector at each damper per code. Smoke dampers may be provided by electrical or fire contractor to allow communication with fire alarm system. Dynamic type. The fire dampers to be US standard for 1-1/2 hour listing. Motors to be UL listed. Provide the thermal protection via the fusible link. Damper to be normally closed. Minimum leakage Class II damper. Provide with automatic reset. Damper to fail closed when power is interrupted to actuator.
- B. Approved Manufacturers:
  - 1. Ruskin
  - 2. Greenheck
  - 3. Penn
  - 4. Nailor
  - 5. Cesco

### **1.3 SUMMARY**

- A. This Section includes a description of required accessories for fire/smoke dampers.

### **1.4 SUBMITTALS**

- A. General: Submit in accordance with Section 01300.
- B. Closeout Submittals:
  - 1. Submit under provisions of Section 01700.
  - 2. Warranty: Submit specified warranty.



**1.5 WARRANTY**

- A. Comply with provisions of Section 01740.

**- END OF SECTION -**

## **- SECTION 23 3313.23 -**

# **BACKDRAFT DAMPERS (SMALL)**

---

## **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 SECTION 23 33 13.23 - BACKDRAFT DAMPERS (SMALL):**

- A. All welded 14 gauge aluminum, with blades pivoting off center, double crimped in front and rear, polyurethane seals. Link blades to work in unison, pivoting in ball bearings, and provide adjustable counterweights attached to the blades. Blades start to open at 0.05" APD – 55 FPM. Blades fully open at 0.06" APD – 680 FPM.
- B. Frames: Channel type with flanges to facilitate mounting.
- C. Approved Manufacturers:
  - 1. Ruskin
  - 2. Greenheck
  - 3. Penn
  - 4. Nailor
  - 5. Cesco

### **1.3 SUMMARY**

- A. This Section includes more detail on backdraft dampers.

### **1.4 SUBMITTALS**

- A. General: Submit in accordance with Section 01300.
- B. Closeout Submittals:
  - 1. Submit under provisions of Section 01700.
  - 2. Warranty: Submit specified warranty.

**1.5 WARRANTY**

- A. Comply with provisions of Section 01740.

**- END OF SECTION -**

**- SECTION 23 3616 -****AIR TERMINAL UNITS**

---

**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 23 3616 AIR TERMINAL UNITS:**

- A. Design Standard - Design and specify work to include materials, installation, and testing for air volume terminal units, including reheat central air terminals for a complete and operating system.
- B. General:
1. Variable air volume (VAV) systems shall typically be zoned so that three to five offices are ganged on a temperature sensor. Offices grouped together shall be ganged in a logical manner, such as having the same floor area, building face exposure, and similar internal loads. Corner zones shall always be an independent zone not connected to any other rooms.
  2. VAV boxes shall have a minimum position setting for ventilation air requirements.
  3. Use of reheat coils shall be limited to hot water reheat coils. Utilize two row coils only where necessary to meet space temperature loads. 5/8-inch OD seamless copper tubes mechanically expanded to aluminum fins. 150 PSIG working pressure. Sweat connections.
  4. VAV boxes with perimeter radiation shall be sequenced from the same room temperature sensor to ensure that the systems do not "fight" each other.
  5. VAV boxes that are DDC type shall have factory-installed controls. Controls are to be furnished by the controls contractor.
  6. When multiple boxes are used to serve a single zone, all shall be controlled from a single thermostat.
  7. Location of all boxes shall be accessible for maintenance.
  8. Box controls shall be pressure independent.
- C. Approved Manufacturers:
1. Air Terminal Boxes:
    - a. Trane
    - b. Titus
    - c. Tuttle and Bailey

- d. Envirotec
- e. Carnes
- f. Nailor

- D. Substitutes Allowed:
  - 1. Yes, if performance and quality equivalency can be evidenced.
- E. Associated Design Standards and Construction Specifications:
  - 1. 23 05 29 – Hangers and Supports for HVAC Piping and Equipment
  - 2. 23 05 53 – Identification for HVAC Piping and Equipment
  - 3. 23 05 93 – Testing, Adjusting and Balancing
  - 4. 23 31 00 – Ductwork Design Standard
  - 5. 25 55 00 – Building Management System Design Standard

### 1.3 SUMMARY

- A. This Section includes information for air terminal boxes.

### 1.4 SUBMITTALS

- A. General: Submit in accordance with Section 01300.
- B. Closeout Submittals:
  - 1. Submit under provisions of Section 01700.
  - 2. Warranty: Submit specified warranty.

### 1.5 WARRANTY

- A. Comply with provisions of Section 01740.

**- END OF SECTION -**

**- SECTION 23 3713****AIR OUTLETS AND INLETS**

---

**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 23 3713 AIR OUTLETS AND INLETS:**

- A. Design Standard - Design and specify work to include materials, installation, and testing of HVAC outlets and inlets for a complete and operating system.
- B. General:
1. Where possible, balancing dampers shall be located at the branch take-off instead of at the diffuser to reduce air noise. Where this is not possible, the damper at the diffuser shall be screwdriver operated.
  2. Grilles, registers and diffusers:
    - a. Indicate 1-, 2-, 3-, or 4-way deflection so as to reduce chances of drafts.
    - b. Coordinate mounting frames with construction types per finish schedule.
    - c. Provide components that have velocity, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current standard literature, which are plus or minus 10 percent of the components as listed in the Diffuser, Register and Grille Schedule, or as specified herein.
  3. Gravity intake and relief penthouses:
    - a. Storm-roof, gravity type. Penthouse: Aluminum or fiberglass. Cover: Removable and lined with fiberglass insulation to prevent condensation. Provide bird-screen, roof curb, and anti-condensation coating.
- C. Approved Manufacturers:
1. Grilles, Registers and Diffusers:
    - a. Titus
    - b. Tuttle and Bailey
    - c. Krueger
    - d. Price
    - e. Carnes
    - f. Nailor

2. Gravity intake and relief penthouses:

- a. Acme
- b. Breidert
- c. Carnes
- d. Greenheck
- e. JencoFan
- f. ILG
- g. Cook
- h. Penn

D. Substitutes Allowed:

- 1. Yes, if performance and quality equivalency can be evidenced.

E. Associated Design Standards and Construction Specifications:

- 1. 23 05 93 – Testing, Adjusting and Balancing
- 2. 23 31 00 – Ductwork Design Standard

**1.3 SUMMARY**

- A. This Section includes information for air outlets and inlets including grilles, registers and diffusers, and gravity intake and relief penthouse.

**1.4 SUBMITTALS**

- A. General: Submit in accordance with Section 01300.
- B. Closeout Submittals:
  - 1. Submit under provisions of Section 01700.
  - 2. Warranty: Submit specified warranty.

**1.5 WARRANTY**

- A. Comply with provisions of Section 01740.

**- END OF SECTION -**

## **- SECTION 23 4000 -**

# **FILTERS**

---

### **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 SECTION 23 4000 - FILTERS:**

- A. Provide minimum MERV-13 filters for LEED projects. Size for maximum velocity of 500 feet per minute. Filters shall be standard dimensions.
- B. Approved Manufacturers:
  - 1. American Air Filter
  - 2. Camfil Farr

#### **1.3 SUMMARY**

- A. This Section includes a description of filters acceptable for HVAC installations.
  - 1. Concrete (unpainted).
  - 2. Concrete unit masonry (unpainted and unglazed).

#### **1.4 SUBMITTALS**

- A. General: Submit in accordance with Section 01300.
- B. Closeout Submittals:
  - 1. Submit under provisions of Section 01700.
  - 2. Warranty: Submit specified warranty.

#### **1.5 WARRANTY**

- A. Comply with provisions of Section 01740.

**- END OF SECTION -**





## - SECTION 23 5700 -

# HEAT EXCHANGERS

---

### **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 SECTION 23 57 00 - HEAT EXCHANGERS:**

- A. Plate and Frame Exchanger: Pressure plate and frame supporting heat transfer plates to be carbon steel. Heat transfer surfaces to be corrugated Type 304 stainless steel. Piping connections to be ANSI flanges. Minimum 150 PSIG working pressure to conform to ASME rules for pressure vessels. Install as recommended by manufacturer and provide adequate clearance for cleaning.
- B. Acceptable Manufacturers:
  - 1. Bell and Gossett
  - 2. Alfa Laval
  - 3. Taco
  - 4. Polaris
  - 5. Graham
  - 6. or equal

#### **1.3 SUMMARY**

- A. This Section includes information on heat exchangers.

#### **1.4 SUBMITTALS**

- A. General: Submit in accordance with Section 01300.
- B. Closeout Submittals:
  - 1. Submit under provisions of Section 01700.
  - 2. Warranty: Submit specified warranty.

**1.5 WARRANTY**

- A. Comply with provisions of Section 01740.

**- END OF SECTION -**

**- SECTION 23 6000 -**

**CHILLED WATER 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 23 60 00 CHILLED WATER SYSTEMS:**

- A. General: All chilled water systems shall have refrigerant systems that meet all LEED requirements for refrigerant use with regards to ozone depletion and global warming.

**1.3 SUMMARY**

- A. This Section includes information on the refrigerants to be used in the chilled water systems.

**1.4 SUBMITTALS**

- A. General: Submit in accordance with Section 01300.
- B. Closeout Submittals:
  - 1. Submit under provisions of Section 01700.
  - 2. Warranty: Submit specified warranty.

**1.5 WARRANTY**

- A. Comply with provisions of Section 01740.

**- END OF SECTION -**



## **- SECTION 23 6416 -**

# **WATER COOLED CHILLERS**

---

## **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 SECTION 23 64 16 - WATER-COOLED CHILLERS:**

- A. Water cooled, centrifugal type, assembled at the factory on a steel base. Individual performance test at full and part load conditions. Units to be leak tested and provided with a full operating charge of refrigerant
- B. Water cooled centrifugal type.
- C. Locate indoors in a refrigeration machinery rooms.
- D. Design with variable frequency drive.
- E. Design with integral touch screen control panel.
- F. Design with integration to campus wide control system.
- G. Acceptable Manufacturers:
  - 1. Trane
  - 2. Governair
  - 3. Aeon
  - 4. York
  - 5. Carrier

### **1.3 SUMMARY**

- A. This Section includes information on the water-cooled chillers for this project.

### **1.4 SUBMITTALS**

- A. General: Submit in accordance with Section 01300.

- B. Closeout Submittals:
  - 1. Submit under provisions of Section 01700.
  - 2. Warranty: Submit specified warranty.

**1.5 WARRANTY**

- A. Comply with provisions of Section 01740.

**- END OF SECTION -**

## **- SECTION 23 6500 -**

# **INDUCED DRAFT COUNTERFLOW COOLING TOWERS**

---

## **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 SECTION 23 65 00 - INDUCED DRAFT COUNTER FLOW COOLING TOWERS:**

- A. Factory assembled, sectional, counter-flow, induced draft design. Fan assemblies built completely into the pan with moving parts factory mounted and aligned.
- B. Factory assembled, all steel components: Hot-dip galvanized steel with cut edges given a protective coat of zinc-rich compound, with a final coating of zinc chromated aluminum.
- C. Stainless steel sumps.
- D. Acceptable Manufacturers:
  - 1. BAC
  - 2. Marley
  - 3. Evapco

### **1.3 SUMMARY**

- A. This Section includes information on cooling towers.

### **1.4 SUBMITTALS**

- A. General: Submit in accordance with Section 01300.
- B. Closeout Submittals:
  - 1. Submit under provisions of Section 01700.
  - 2. Warranty: Submit specified warranty.



**1.5 WARRANTY**

- A. Comply with provisions of Section 01740.

**- END OF SECTION -**

**- SECTION 23 7513 -**

**CUSTOM PACKAGED AIR HANDLING UNIT**

---

**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 23 7513 AIR HANDLING UNITS:**

- A. Design Standard - Design and specify work to include materials, installation, and testing of central station air handling unit for a complete and operable system.
- B. General:
  - 1. All air handling units shall have, at minimum, a dedicated set of two-position outside air dampers for ventilation requirements plus a second set of modulating outside air dampers, as required, for economizer operation or tracking with exhaust air.
  - 2. A full coil section width casing with access door shall be used to separate the chilled and heating coils.
  - 3. Coils shall be copper coils with copper fins.
  - 4. Insulated casings and plenums shall be specified for all units, including those serving heat and vent applications. Provide double wall casings at all locations.
  - 5. Casings for heat and vent applications shall have space for installation of future cooling coil.
  - 6. Units shall be installed to allow removal of all coils and filters. Clearance equal to full finned width of coil shall be provided to facilitate removal.
  - 7. Units shall be mounted on internal vibration isolators and concrete housekeeping pads.
  - 8. Units shall have a mixing box and filter box or a combination filter/mixing box properly sized so as not to exceed the filter manufacturer's recommended face velocities. Low leakage dampers (2%) shall be provided for mixing box dampers.
  - 9. All cooling coil drain pans shall be stainless steel.
  - 10. Variable speed drives shall be installed on the air handlers in a separate conditioned vestibule.
- C. Approved Manufacturers:
  - 1. Air Handlers:
    - a. Temptrol
    - b. Governair

- c. Team Air
  - d. Haakon
  - e. Hunt Air
  - f. Dynamic Air Technologies
  - g. Scott Springfield
- D. Substitutes Allowed:
- 1. Yes, if performance and quality equivalency can be evidenced.
- E. Associated Design Standards and Construction Specifications:
- 1. 23 05 29 – Hangers and Supports for HVAC Piping and Equipment
  - 2. 23 05 48 – Vibration and Seismic Controls for HVAC Piping and Equipment
  - 3. 23 05 53 – Identification for HVAC Piping and Equipment
  - 4. 23 05 93 – Testing, Adjusting and Balancing
  - 5. 23 31 00 - Ductwork

**1.3 SUMMARY**

- A. This Section includes information for custom packaged, outdoor central-station air handling unit.

**1.4 SUBMITTALS**

- A. General: Submit in accordance with Section 01300.
- B. Closeout Submittals:
  - 1. Submit under provisions of Section 01700.
  - 2. Warranty: Submit specified warranty.

**1.5 WARRANTY**

- A. Comply with provisions of Section 01740.

**- END OF SECTION -**

# DIVISION 25 – BUILDING MANAGEMENT SYSTEMS

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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

T.A.C. Controls  
Chris Wilkins  
1 South Linden Avenue Suite 1  
South San Francisco, CA 94080  
(650) 616-7403  
Chris.wilkins@tac.com

## **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 Contollers 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.
- K. VAV Controller Functionality (INVENSYS IA-SERIES)
  1. Controls shall be microprocessor based Pressure Independent Variable Air Volume Digital Controllers, as shown in the drawings. The VAV IA controller shall be a single integrated package consisting of a microprocessor, power supply, damper actuator, differential pressure transducer, field terminations, and application software. An alternate model shall be offered that allows for direct connectivity to an external actuator for those applications that employ a non-butterfly style damper configuration. All input/output signals shall be directly hardwired to the VAV IA controller. The internal actuator shall employ a manual override that allows for powered or non-powered adjustment of the damper position. In all cases, the controller shall automatically resume proper operation following the return of power to, or control by the IA. Programming, configuring and/or troubleshooting of input/output signals shall be easily executed through the IA sensor or GP tool connected at the wall sensor location.
  2. The VAV IA control algorithms shall be designed to limit the frequency of damper repositioning, to assure a minimum 10-year life from all components. The VAV IA controller shall provide internal differential pressure transducer for pressure independent applications with an accuracy of  $\pm 5\%$ . Flows through transducers requiring filter maintenance are not acceptable. The VAV IA shall provide zone control accuracy equal to or better than  $\pm 1$  degree Fahrenheit. Systems providing control accuracy's greater than  $\pm 1$  degrees Fahrenheit are not acceptable. With the submittal package, contractor shall provide performance data that verifies control accuracy of the VAV IA controller.
  3. All input/output signals shall be directly hardwired to the VAV IA controller.

A minimum of one input point of the VAV IA controller shall employ a universal configuration that allows for flexibility in application ranging from dry contact, resistive, to voltage/current sourced inputs. If a universal point is not available, a minimum of one input point (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 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 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.

4. The BMS contractor shall provide VAV IA controller to the VAV box manufacturer, for factory mounting. The VAV terminal unit supplier shall include in its price all costs for mounting of VAV IA controller, connection of actuator to damper shaft, wiring of device power, wiring of VAV IA controller to fan (fan powered terminal) and wiring to electric reheat coils or reheat valve actuator as specified on drawing.
5. The VAV terminal manufacturer shall provide a multi-point, averaging, differential pressure sensor mounted on the inlet to each VAV box. The VAV terminal unit manufacturer shall supply a line to low voltage transformer, of sufficient capacity, to power the VAV IA controller plus all reheat valves and/or contactors and fan circuits associated with the VAV terminal and actuator assemblies. The BMS contractor shall provide all reheat control valves to the mechanical contractor for mounting and piping. The BMS contractor shall provide and install all wiring between the valve and VAV IA controller and between the room sensor and the VAV IA controller.

L. IA VAV - Air Balancing

Through the portable tool, the VAV IA controller shall support a fully prompted Air Balance sequence. The GP tool shall, when connected through the wall sensor, access the connected VAV IA unit. The air balance sequence shall step the balancing contractor through the checkout and calibration of the VAV IA controller. Upon completion of the balancing sequence, the flow values presented by the VAV IA shall match those observed by the balancing contractor's measurement equipment. Additionally, upon completion of the air balance, the SDC shall automatically archive the balance settings for future use if the controller were to require replacement. The BMS contractor will provide the

software tool and cable to the balancer at no cost with a one time one hour instruction. The balancing contractor is required to return the tool in working order as soon as he completes his work.

## 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. Control Damper Actuators (where furnished by the Temperature Control sub-contractor): Two-position or proportional electric actuators shall be direct-mount type sized to provide a minimum of 5 in-lb torque per square foot of damper area. Damper actuators shall be spring return type. Provide one actuator per damper minimum. Pneumatic actuators shall be sized to provide a minimum of 5 in-lb torque per square foot of damper area and shall include positive positioning pneumatic relays when sequenced with other actuators or when control action is to be proportional.
- B. Control Valves: Control valves shall be 2-way or 3-way pattern as shown constructed for tight shutoff and shall operate satisfactorily against system pressures and differentials. Two-position valves shall be 'line' size. Proportional control valves shall be sized for a maximum pressure drop of 5.0 psi at rated flow (except as may be noted on the drawings). Valves with sizes up to and including 2 inches shall be "screwed" configuration and 2-1/2 inch and larger valves shall be "flanged" configuration. Electrically controlled valves shall include spring return type actuators sized for tight shut-off against system pressures and furnished with integral switches for indication of valve position (open-closed). Pneumatically actuators for valves, when utilized, shall be sized for tight shut-off against system pressures. Three-way butterfly valves, when utilized, shall include a separate actuator for each butterfly segment.
- 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. Duct Mount, Pipe Mount and Outside Air Temperature Sensors: 10,000-ohm thermistor temperature sensors with an accuracy of  $\pm 0.2^{\circ}\text{C}$ . Outside air sensors shall include an integral sun shield.
- E. Current Sensitive Switches: Solid state, split core current switch that operates when the current level (sensed by the internal current transformer) exceeds the adjustable trip point. Current switch to include an integral LED for indication of trip condition and a current level below trip set point.
- H. 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.
- I. Water Flow Meters (when required): Water flow meters shall be axial turbine style flow meters which translate liquid motion into electronic output signals proportional to the flow sensed. Flow sensing turbine rotors shall be non-metallic and not impaired by magnetic drag. Flow meters shall be 'insertion' type complete with 'hot-tap' isolation valves to enable sensor removal without water supply system shutdown. Accuracy shall be  $\pm 2\%$  of actual reading from 0.4 to 20 feet per second flow velocities.
- J. Water Differential Pressure Switch: Switch shall measure the pressure difference between two sources and activate a SPDT switch upon an adjustable change in pressure differential. Pressure differential set point shall be adjustable between 8-70 psi. Switches shall be selected to withstand expected system pressures. Switch electrical rating shall be 20 amp at 120 VAC.
- K. Ambient Light Sensor: Ambient light sensor designed to provide an analog output signal proportional to the ambient light present. Sensor shall contain a precision photo-diode type cell for light measurement. Sensor shall be designed for outdoor application and be directed towards the

north sky, away from lighted signs, outdoor lights or similar light producing equipment. Maximum range shall be adjustable from 5 to 750 foot-candles at the sensor face. Accuracy shall be  $\pm 1\%$  at 70 degrees F.

- L. 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 0500 -**

**COMMON WORK RESULTS FOR ELECTRICAL**

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**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. Electrical equipment coordination, sleeves and sleeve seals for raceways and cables, and common electrical installation requirements.

**PART 2 - PRODUCTS**

**2.1 MATERAILS**

- A. Sleeves for Raceways and Cables:
  - 1. Steel pipe sleeves.
  - 2. Cast-iron pipe sleeves.
  - 3. Sleeves for rectangular openings.
- B. Sleeve Seals: Modular sealing devices with EPDM sealing elements, plastic, carbon-steel pressure plates, and carbon or stainless connecting bolts and nuts.

**- END OF SECTION -**





**- SECTION 26 0513 -****MEDIUM-VOLTAGE 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. Cables for medium-voltage electrical distribution systems.

**1.3 QUALITY ASSURANCE:**

- A. Quality Standards: IEEE C2 and NFPA 70.

**1.4 COMPONENTS:**

- A. Cables: Type MV90.
  - 1. Conductor: Copper.
  - 2. Conductor Stranding: Compact.
  - 3. Conductor Insulation: Ethylene-propylene rubber.
    - a. Voltage Rating: 5 or 15 kV.
    - b. Insulation Thickness: 133 percent.
  - 4. Shielding: Corrugated copper drain wires embedded in jacket.
  - 5. Cable Jacket: Sunlight-resistant PVC, 80 mils thick.
  - 6. Splice Kits: Combination tape and cold-shrink-rubber sleeve or premolded, cold-shrink rubber and premolded EPDM splicing body types.
  - 7. Solid Terminations:
    - a. Multiconductor Cable Sheath Seals: Compound-filled, cast-metal body and cold-shrink or heat-shrink or cast-epoxy-resin sheath seal kit.
    - b. Nonsheilded-cable terminations.
  - 8. Separable insulated connectors with load-break cable terminations or dead-break cable terminators.

**1.5 SOURCE QUALITY CONTROL:**

- A. Cables: Tested and inspected according to ICEA S-97-682.

**1.6 FIELD QUALITY CONTROL:**

- A. Testing: By contractor-engaged agency or contractor.

**- END OF SECTION -**

**- SECTION 26 0519 -**

**LOW-VOLTAGE ELECTRICAL POWER  
CONDUCTORS AND 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. Building wires, cables, connectors, splices, and terminations for wiring systems rated 600 V and less; and sleeves and sleeve seals for cables.
- B. See Division 26 Section "Medium-Voltage Cables" for single-conductor and multiconductor cables, cable splices, and terminations for electrical distribution systems with 2001 to 35,000 V.

**1.3 QUALITY ASSURANCE**

- A. Quality Standard: NFPA 70.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Conductors and Cables:
  - 1. Conductors: Copper.
  - 2. Conductor Insulation: Types THW, THHN-THWN and XHHW.
  - 3. Multiconductor Cable: Metal-clad cable, Type MC with ground wire.
- B. Connectors and Splices: Factory fabricated.
- C. Sleeves for Raceways and Cables:
  - 1. Steel pipes sleeves.
  - 2. Cast-iron pipe sleeves.
  - 3. Sleeves for rectangular openings.

- D. Sleeve Seals: EPDM insert type sealing elements, pressure plates, and connecting bolts and nuts.

**2.2 CONDUCTOR MATERIAL APPLICATIONS:**

- 1. Feeders: Copper. Solid for No.10 AWG and smaller; stranded for No.8 AWG and larger.
- 2. Branch Circuits: Copper. Solid for No.10 AWG and smaller; stranded for No.8 AWG and larger.

**2.3 CONDUCTOR AND INSULATION APPLICATIONS**

- 1. Service Entrance: Type XHHW, single conductors in raceway.
- 2. Exposed Feeders: Type THHN-THWN, single conductors in raceway.
- 3. Feeders Concealed in Cielings, Walls, Partitions, and Crawlspace: THHN-THWN, single conductors raceway.
- 4. Feeders Concealed on Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.
- 5. Exposed Branch Circuits, Including in Crawlspace: Type THHN-THWN, single conductors in raceway.
- 6. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Metal-clad cable, type MC.
- 7. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.
- 8. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel wire-mesh, strain relief device at terminations to suit application.
- 9. Class 1 Control Circuits: Type THHN-THWN, in raceway.
- 10. Class 2 Control Circuits: Power-limited cable, concealed in building finishes Power-limited tray cable, in cable tray.

**2.4 FIELD QUALITY CONTROL**

- A. Testing: By Contractor-engaged agency or Contractor.
- B. Infrared Scanned: For each splice in cables and conductors No.3 AWG and larger.

**- END OF SECTION -**

**- SECTION 26 0526 -****GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

---

**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. This section specifies general grounding and bonding requirements of electrical equipment operations and to provide a low impedance path for possible ground fault currents.
- B. "Grounding electrode system" refers to all electrodes required by NEC, as well as including made, supplementary, lightning protection system grounding electrodes.
- C. The terms "connect" and "bond" are used interchangeably in this specification and have the same meaning.

**1.3 RELATED WORK**

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.
- B. Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Low Voltage power and lighting wiring.
- C. Section 26 41 13, FACILITY LIGHTNING PROTECTION: Requirements for a lightning protection system.

**1.4 SUBMITTALS**

- A. Submit in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
- B. Shop Drawings:
  - 1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.

2. Include the location of system grounding electrode connections and the routing of aboveground and underground grounding electrode conductors.
- C. Test Reports: Provide certified test reports of ground resistance.
- D. Certifications: Two weeks prior to final inspection, submit four copies of the following to the Resident Engineer:
  1. Certification that the materials and installation is in accordance with the drawings and specifications.
  2. Certification, by the Contractor, that the complete installation has been properly installed and tested.

## 1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
  1. B1-2001 Standard Specification for Hard-Drawn Copper Wire
  2. B8-2004 Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
- C. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
  1. 81-1983 IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
- D. National Fire Protection Association (NFPA):
  1. 70-2005 National Electrical Code (NEC)
  2. 99-2005 Health Care Facilities
- E. Underwriters Laboratories, Inc. (UL):
  1. 44-2005 Thermoset-Insulated Wires and Cables
  2. 83-2003 Thermoplastic-Insulated Wires and Cables
  3. 467-2004 Grounding and Bonding Equipment
  4. 486A-486B-2003 Wire Connectors

## PART 2 - PRODUCTS

### 2.1 GROUNDING AND BONDING CONDUCTORS

- A. Equipment grounding conductors shall be UL 83 insulated stranded copper, except that sizes 6 mm<sup>2</sup> (10 AWG) and smaller shall be solid copper. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes 25 mm<sup>2</sup> (4 AWG) and larger shall be permitted to be identified per NEC.

- B. Bonding conductors shall be ASTM B8 bare stranded copper, except that sizes 6 mm<sup>2</sup> (10 AWG) and smaller shall be ASTM B1 solid bare copper wire.
- C. Isolated Power System: Type XHHW-2 insulation with a dielectric constant of 3.5 or less.
- D. Electrical System Grounding: Conductor sizes shall not be less than what is shown on the drawings and not less than required by the NEC, whichever is greater.

## 2.2 GROUND RODS

- A. Copper clad steel, 19 mm (3/4-inch) diameter by 3000 mm (10 feet) long, conforming to UL 467.
- B. Quantity of rods shall be as required to obtain the specified ground resistance.

## 2.3 SPLICES AND TERMINATION COMPONENTS

- A. Components shall meet or exceed UL 467 and be clearly marked with the manufacturer, catalog number, and permitted conductor size(s).

## 2.4 GROUND CONNECTIONS

- A. Below Grade: Exothermic-welded type connectors.
- B. Above Grade:
  - 1. Bonding Jumpers: compression type connectors, using zinc-plated fasteners and external tooth lockwashers.
  - 2. Ground Busbars: Two-hole compression type lugs using tin-plated copper or copper alloy bolts and nuts.
  - 3. Rack and Cabinet Ground Bars: one-hole compression-type lugs using zinc-plated or copper alloy fasteners.

## 2.5 EQUIPMENT RACK AND CABINET GROUND BARS

- A. Provide solid copper ground bars designed for mounting on the framework of open or cabinet-enclosed equipment racks with minimum dimensions of 4 mm thick by 19 mm wide (3/8 inch x 3/4 inch).

## 2.6 GROUND TERMINAL BLOCKS

- A. At any equipment mounting location (e.g. backboards and hinged cover enclosures) where rack-type ground bars cannot be mounted, provide screw lug-type terminal blocks.

## 2.7 SPLICE CASE GROUND ACCESSORIES

- A. Splice case grounding and bonding accessories shall be supplied by the splice case manufacturer when available. Otherwise, use 16 mm<sup>2</sup> (6 AWG) insulated ground wire with shield bonding connectors.



## **PART 3 - EXECUTION**

### **3.1 GENERAL**

- A. Ground in accordance with the NEC, as shown on drawings, and as hereinafter specified.
- B. System Grounding:
  - 1. Secondary service neutrals: Ground at the supply side of the secondary disconnecting means and at the related transformers.
  - 2. Separately derived systems (transformers downstream from the service entrance): Ground the secondary neutral.
  - 3. Isolation transformers and isolated power systems shall not be system grounded.
- C. Equipment Grounding: Metallic structures (including ductwork and building steel), enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits shall be bonded and grounded.
- D. Special Grounding: For patient care area electrical power system grounding, conform to NFPA 99, and NEC.

### **3.2 INACCESSIBLE GROUNDING CONNECTIONS**

- A. Make grounding connections, which are buried or otherwise normally inaccessible (except connections for which periodic testing access is required) by exothermic weld.

### **3.3 MEDIUM-VOLTAGE EQUIPMENT AND CIRCUITS**

- A. Switchgear: Provide a bare grounding electrode conductor from the switchgear ground bus to the grounding electrode system.
- B. Duct Banks and Manholes: Provide an insulated equipment grounding conductor in each duct containing medium or high voltage conductors, sized per NEC except that minimum size shall be 25 mm<sup>2</sup> (2 AWG). Bond the equipment grounding conductors to the switchgear ground bus, to all manhole hardware and ground rods, to the cable shielding grounding provisions of medium or high voltage cable splices and terminations, and equipment enclosures.
- C. Pad Mounted Transformers:
  - 1. Provide a driven ground rod and bond with a grounding electrode conductor to the transformer grounding pad metal steel.
  - 2. Ground the secondary neutral.
- D. Lightning Arresters: Connect lightning arresters to the equipment ground bus or ground rods as applicable.

- E. Outdoor Metallic Fences Around Electrical Equipment: Fences shall be grounded as indicated. Fences shall be grounded with a ground rod at each fixed gate post and at each corner post. Drive ground rods until the top is 300 mm (12 inches) below grade. Attach a 25 mm<sup>2</sup> (4 AWG) copper conductor, by exothermic weld to the ground rods and extend underground to the immediate vicinity of fence post. Lace the conductor vertically into 300 mm (12 inches) of fence mesh and fasten by two approved bronze compression fittings, one to bond wire to post and the other to bond wire to fence. Each gate section shall be bonded to its gatepost by a 3 by 25 mm (1/8 by one inch) flexible braided copper strap and ground post clamps. Clamps shall be of the anti-electrolysis type.
- F. Metallic Conduit: Metallic conduits which terminate without mechanical connection to an electrical equipment housing by means of locknut and bushings or adapters, shall be provided with grounding bushings. Connect bushings with a bare grounding conductor to the equipment ground bus.

### 3.4 SECONDARY EQUIPMENT AND CIRCUITS

- A. Main Bonding Jumper: Bond the secondary service neutral to the ground bus in the service equipment.
- B. Metallic Piping, Building Steel, and Supplemental Electrode(s):
  - 1. Provide a grounding electrode conductor sized per NEC between the service equipment ground bus and all metallic water and gas pipe systems, building steel, and supplemental or made electrodes. Jumper insulating joints in the metallic piping. All connections to electrodes shall be made with fittings that conform to UL 467.
  - 2. Provide a supplemental ground electrode and bond to the grounding electrode system.
- C. Service Disconnect (Separate Individual Enclosure): Provide a ground bar bolted to the enclosure with lugs for connecting the various grounding conductors.
- D. Switchgear, Switchboards, Unit Substations, and Motor Control Centers:
  - 1. Connect the various feeder equipment grounding conductors to the ground bus in the enclosure with suitable pressure connectors.
  - 2. For service entrance equipment, connect the grounding electrode conductor to the ground bus.
  - 3. Connect metallic conduits, which terminate without mechanical connection to the housing, by grounding bushings and grounding conductor to the equipment ground bus.
- E. Transformers:
  - 1. Exterior: Exterior transformers supplying interior service equipment shall have the neutral grounded at the transformer secondary. Provide a grounding electrode at the transformer.
  - 2. Separately derived systems (transformers downstream from service equipment): Ground the secondary neutral at the transformer. Provide a grounding electrode conductor from the transformer to the nearest component of the grounding electrode system the ground bar at the service equipment .

- F. Conduit Systems:
  - 1. Ground all metallic conduit systems. All metallic conduit systems shall contain an equipment grounding conductor.
  - 2. Non-metallic conduit systems shall contain an equipment grounding conductor, except that non-metallic feeder conduits which carry a grounded conductor from exterior transformers to interior or building-mounted service entrance equipment need not contain an equipment grounding conductor.
  - 3. Conduit containing only a grounding conductor, and which is provided for mechanical protection of the conductor, shall be bonded to that conductor at the entrance and exit from the conduit.
- G. Feeders and Branch Circuits: Install equipment grounding conductors with all feeders and power and lighting branch circuits.
- H. Boxes, Cabinets, Enclosures, and Panelboards:
  - 1. Bond the equipment grounding conductor to each pullbox, junction box, outlet box, device box, cabinets, and other enclosures through which the conductor passes (except for special grounding systems for intensive care units and other critical units shown).
  - 2. Provide lugs in each box and enclosure for equipment grounding conductor termination.
  - 3. Provide ground bars in panelboards, bolted to the housing, with sufficient lugs to terminate the equipment grounding conductors.
- I. Motors and Starters: Provide lugs in motor terminal box and starter housing or motor control center compartment to terminate equipment grounding conductors.
- J. Receptacles shall not be grounded through their mounting screws. Ground with a jumper from the receptacle green ground terminal to the device box ground screw and the branch circuit equipment grounding conductor.
- K. Ground lighting fixtures to the equipment grounding conductor of the wiring system when the green ground is provided; otherwise, ground the fixtures through the conduit systems. Fixtures connected with flexible conduit shall have a green ground wire included with the power wires from the fixture through the flexible conduit to the first outlet box.
- L. Fixed electrical appliances and equipment shall be provided with a ground lug for termination of the equipment grounding conductor.
- M. Raised Floors: Provide bonding of all raised floor components. See details on the drawings.
- N. Panelboard Bonding: The equipment grounding terminal buses of the normal and essential branch circuit panelboards serving the same individual patient vicinity shall be bonded together with an insulated continuous copper conductor not less than 16 mm<sup>2</sup> (10 AWG). These conductors shall be installed in rigid metal conduit.

### 3.5 CORROSION INHIBITORS

- A. When making ground and ground bonding connections, apply a corrosion inhibitor to all contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between the metals used.

**3.6 CONDUCTIVE PIPING**

- A. Bond all conductive piping systems, interior and exterior, to the building to the grounding electrode system. Bonding connections shall be made as close as practical to the equipment ground bus.
- B. In operating rooms and at intensive care and coronary care type beds, bond the gases and suction piping, at the outlets, directly to the room or patient ground bus.

**3.7 LIGHTNING PROTECTION SYSTEM**

- A. Bond the lightning protection system to the electrical grounding electrode system.

**3.8 ELECTRICAL ROOM GROUNDING**

- A. Building Earth Ground Busbars: Provide ground busbar hardware at each electrical room and connect to pigtail extensions of the building grounding ring.

**3.9 3.9 WIREWAY GROUNDING**

- A. Ground and Bond Metallic Wireway Systems as follows:
- B. Bond the metallic structures of wireway to provide 100 percent electrical continuity throughout the wireway system by connecting a 16 mm<sup>2</sup> (6 AWG) bonding jumper at all intermediate metallic enclosures and across all section junctions.
- C. Install insulated 16 mm<sup>2</sup> (6 AWG) bonding jumpers between the wireway system bonded as required in paragraph 1 above, and the closest building ground at each end and approximately every 16 meters (50 feet).
- D. Use insulated 16 mm<sup>2</sup> (6 AWG) bonding jumpers to ground or bond metallic wireway at each end at all intermediate metallic enclosures and cross all section junctions.
- E. Use insulated 16 mm<sup>2</sup> (6 AWG) bonding jumpers to ground cable tray to column-mounted building ground plates (pads) at each end and approximately every 15 meters.

**3.10 GROUND RESISTANCE**

- A. Grounding system resistance to ground shall not exceed 5 ohms. Make necessary modifications or additions to the grounding electrode system for compliance without additional cost to the Owner. Final tests shall assure that this requirement is met.
- B. Resistance of the grounding electrode system shall be measured using a four-terminal fall-of-potential method as defined in IEEE 81. Ground resistance measurements shall be made before the electrical distribution system is energized and shall be made in normally dry conditions not less than 48 hours after the last rainfall. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together below grade. The combined resistance of separate systems may be used to meet the required resistance, but the specified number of electrodes must still be provided.

- C. Services at power company interface points shall comply with the power company ground resistance requirements.
- D. Below-grade connections shall be visually inspected by the Resident Engineer prior to backfilling. The Contractor shall notify the Resident Engineer 24 hours before the connections are ready for inspection.

**3.11 GROUND ROD INSTALLATION**

- A. Drive each rod vertically in the earth, not less than 3000 mm (10 feet) in depth.
- B. Where permanently concealed ground connections are required, make the connections by the exothermic process to form solid metal joints. Make accessible ground connections with mechanical pressure type ground connectors.
- C. Where rock prevents the driving of vertical ground rods, install angled ground rods or grounding electrodes in horizontal trenches to achieve the specified resistance.

**- END OF SECTION -**

# - SECTION 26 0529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

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## 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.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Support, Anchorage, and Attachment Components:
1. Steel slotted support systems with metallic, nonmetallic, painted coatings.
  2. Nonmetallic slotted support systems.
  3. Raceway and cable supports.
  4. Steel, Steel and malleable-iron conduit and cable hangers, clamps, and associated accessories.
  5. Support for non-armored conductors and cables in vertical conduit risers
  6. Structural steel for fabricated supports and restraints.
  7. Mounting, Anchoring, and Attachment Components:
    - a. Power-actuated fasteners.
    - b. Mechanical-expansion anchors.
    - c. Concrete inserts.
    - d. Clamps for attachment to steel structural elements.
    - e. All steel, springhead toggle bolts.
    - f. Threaded hanger rods.
- B. Fabricated Metal Equipment Support Assemblies: Welded or bolted steel shapes.
- C. Concrete Bases: 3000-psi (20.7-MPa), 28-day compressive-strength concrete.
- D. Examine conditions and proceed with work when substrates are ready.

**2.2 INSTALLATION:**

- A. Install vertical support members for equipment and luminaires, straight and parallel to building walls.
- B. Do not use other trade's fastening devices as supporting means for electrical equipment materials or fixtures.
- C. Support conduits within 18 inches of outlets, boxes, panels, cabinets and deflections.
- D. Maximum distance between supports not to exceed 8 foot spacing.
- E. Verify mounting height of luminaires or items prior to installation of supporting devices when heights are not detailed.
- F. Install vertical support members for equipment and luminaires, straight and parallel to building walls

**- END OF SECTION -**

## **- SECTION 26 0533 -**

# **RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS**

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## **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. Raceway, fitting, boxes, enclosures, and cabinets for electrical wiring.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Metal Conduit and Tubing:
  - 1. EMT.
  - 2. FMC: Aluminum
- B. Nonmetallic Conduit and Tubing: ENT
- C. Optical Fiber/Communications Cable Raceway and Fittings: Plenum, Riser, General-use type, depending on the application.
- D. Metal Wireways: Sheet metal. NEMA Type 1,3R.
  - 1. Wireway Covers: Hinged, Screw-cover, Flanged-and-gasketed type.
- E. Nonmetallic Wireways: PVC plastic.
- F. Surface Raceways: Metal, galvanized steel.
- G. Boxes, Enclosures, and Cabinets:
  - 1. Outlet and Device Boxes: Sheet metal
  - 2. Floor Boxes: Cast metal.



3. Pull and Junction Boxes: Sheet metal.
  4. Hinged-Cover Enclosures: Metal.
  5. Cabinets: Galvanized steel.
- H. Hand holes and Boxes for Exterior Underground Wiring: Poly concrete, polymer-concrete frame and cover, prototype tested for compliance with SCTE 77.
- I. Sleeves for Raceways: Steel pipe or Rectangular galvanized sheet steel.
- J. Sleeve Seals: EPDM sealing element.

## 2.2 INSTALLATION:

- A. Raceway Applications:
1. Outdoors:
    - a. Exposed IMC or EMT or RNC, Type EPC-40-PVC
    - b. Concealed, Aboveground: EMT, PVC.
    - c. Underground: RNC, Type EPC-40-PVC, direct buried.
    - d. Connection to vibrating Equipment: LFMC.
    - e. Boxes and Enclosures, Aboveground: NEMA Type 3R or 12.
    - f. Underground Hand holes and Boxes: SCTE tier 15 structural load rating.
  2. Indoors:
    - a. Exposed: EMT.
    - b. Exposed and Subject to Severe Damage: IMC.
    - c. Concealed: EMT
    - d. Connection to Vibrating Equipment: FMC, except LFMC in damp or wet locations.
    - e. Damp or Wet Locations: IMC.
    - f. Raceways for Distribution of Optical Fiber or Communications Cable: Optical fiber/communications cable raceway or EMT.
    - g. Boxes and Enclosures: NEMA Type1, except Type 4 in damp or wet locations.

**- END OF SECTION -**

**- SECTION 26 0536 -****CABLE TRAYS FOR ELECTRICAL SYSTEMS**

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**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 QUALITY ASSURANCE**

- A. Quality Standard: NEMA VE1.

**PART 2 - PRODUCTS****2.1 MATERIALS**

- A. Cable Trays, Fitting, and Accessories: Steel.
  - 1. Factory-standard primer, ready for field painting; with cadmium-plated hardware.
  - 2. Mill galvanized before fabrication; with galvanized hardware.
  - 3. Electrogalvanized before fabrication; with galvanized hardware.
  - 4. Hot-dip galvanized after fabrication; with chromium-zinc hardware.
  - 5. PVC coated; with chromium-zinc Type 316 stainless-steel hardware.
  - 6. Epoxy-resin paint; with cadmium-plated hardware.
- B. Cable Trays, Fitting, and Accessories: Aluminum, with chromium-zinc hardware.
- C. Cable Trays, Fitting, and Accessories: Stainless steel, Type 304.
- D. Cable Trays, Fitting, and Accessories: Fiberglass; with fiberglass-encapsulated, stainless-steel hardware.
- E. Cable Tray Accessories:
  - 1. Barrier strips.
  - 2. Cable tray supports and connectors.
- F. Warning signs.

## 2.2 SOURCE QUALITY CONTROL

- A. Testing according to NEMA FG 1.

**- END OF SECTION -**

**- SECTION 26 0548 -****VIBRATION AND SEISMIC CONTROLS FOR  
ELECTRICAL SYSTEMS**

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**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 PERFORMANCE REQUIREMENTS:**

- A. Seismic-Restraint Loading:
  - 1. Site Class as Defined in the IBC
  - 2. Assigned Seismic Use Group or Building Category as Defined in the IBC: I, II, III.
    - a. Component Important Factor: 1.5.
    - b. Component Response Modification Factor: 5.0.
    - c. Component Amplification Factor: 2.5.
  - 3. Design Spectral Response Acceleration at Short Periods (0.2 seconds):
  - 4. Design Spectral Response Acceleration at 1.0-Second Period.

**PART 2 - PRODUCTS****2.1 MATERIALS**

- A. Vibration Isolators:
  - 1. Neoprene or Rubber pads.
  - 2. Spring isolators.
  - 3. Restrained spring isolators.
- B. Seismic-Restraint Devices:
  - 1. Channel support systems.
  - 2. Galvanized restraint cables.
  - 3. Steel tube or steel slotted-support-system sleeve with internally bolted connection hanger rod stiffeners.

4. Bushings for floor-mounted equipment anchors.
  5. Bushing assemblies for wall-mounted equipment anchorage.
  6. Resilient isolation washers and bushings.
  7. Mechanical anchors.
  8. Adhesive anchors.
- C. Factory Finishes: Standard

## **PART 3 - EXECUTION**

### **3.1 FIELD QUALITY CONTROL**

- A. Testing: By Contractor-engaged

**- END OF SECTION -**

**- SECTION 26 0553 -****IDENTIFICATION FOR ELECTRICAL SYSTEMS**

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**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 QUALITY ASSURANCE**

- A. Comply with ANSI A13.1 and IEEE C2.

**PART 2 - PRODUCTS**

- A. Power Raceway Identification: Self-adhesive vinyl labels or Write-on tags.
- B. Power and Control Cable Identification: Write-on tags or snap around labels or color-coded bands.
- C. Conductor Identification: Color-coding conductor tape or colored insulation.
- D. Floor Marking Tape: Pressure-sensitive vinyl tape.
- E. Underground-Line Warning Tape: Pigmented polyolefin Multilayer laminate.
- F. Warning Labels and Signs: Self-adhesive warning labels.
- G. Instruction Signs: Adhesive film.
- H. Equipment Identification Labels: Engraved Labels.
  - 1. Melamine plastic laminate, white with black core, 1/16-inch thick.
  - 2. Engravers standard letter style, minimum 3/16-inch high capital letters.
  - 3. Drill or punch labels for mechanical fastening except where adhesive mounting is necessary because of substrate. Use self tapping stainless steel screws.
  - 4. Install an engraved label on each major unit of electrical equipment indicating both equipment name and circuit serving equipment (e.g. "EF-1, CKT. 2P1-1,3,5).

5. Install engraved on the inside of flush panels, visible when door is opened. Install label on outside of surface panel.

**- END OF SECTION -**

## **- SECTION 26 0573 -**

# **OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY**

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## **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. Computer-based, fault-current and overcurrent protective device coordination studies. Series-rated devices will not be used.

### **1.3 QUALITY ASSURANCE**

- A. Quality Standards: IEEE 399 and IEEE 242.

### **1.4 COMPONENTS**

- A. Computer software program for plotting and diagramming time-current-characteristics curves and for reporting settings and ratings of all overcurrent protective devices.
- B. Optical Computer Program Features:
  - 1. Arcing faults.
  - 2. Simultaneous faults.
  - 3. Explicit negative sequence.
  - 4. Mutual coupling in zero sequence.

## **PART 2 - EXECUTION**

- A. Fault-Current Study: Electrical distribution system from normal and alternate power sources.
- B. Coordination study includes the following:
  - 1. Transformer primary overcurrent protective devices.
  - 2. Motors served by voltages more than 600 V.



- C. Conductor protection.

**- END OF SECTION -**

## **- SECTION 26 0800 -**

# **COMMISSIONING OF ELECTRICAL SYSTEMS**

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## **PART 1 - GENERAL**

### **1.1 SUMMARY**

- A. This Section includes:
  - 1. Requirements for commissioning the electrical system and its subsystems and equipment. This Section supplements the general requirements specified in Section 01 91 13 – Commissioning.
- B. Specific commissioning requirements are given in the following sections of these specifications.
  - 1. Section 01 91 00 – Commissioning.
  - 2. Section 23 08 00 – HVAC Commissioning (incl. Plumbing).
  - 3. Section 26 08 00 – Electrical Commissioning.

### **1.2 SUBMITTALS**

- A. General:
  - 1. Comply with Section 01 – Submittal Procedures.
  - 2. See submittal requirements in Section 01 91 00 – Commissioning.
- B. Prior to functional testing:
  - 1. Completed pre-functional checklists.

### **1.3 COORDINATION**

- A. The Contractor shall coordinate all major equipment startup and installation with the Commissioning Provider.

## **PART 2 - PRODUCTS**

### **2.1 TEST EQUIPMENT**

- A. All standard testing equipment required to perform startup and initial checkout and required functional performance testing shall be provided by the Trade Contractor for the equipment being tested.

- B. Datalogging equipment or software required to test equipment will be provided by the CP, but shall not become the property of the Owner.
- C. All testing equipment shall be of sufficient quality and accuracy to test or measure system performance required by the Contract Documents.

## **PART 3 - EXECUTION**

### **3.1 TESTING PREPARATION**

- A. General procedures are described in the Division 01 Section "General Commissioning Requirements."
- B. Pre-functional Checklists
  - 1. Contractor shall fill out and sign pre-functional checklists for the following equipment and systems:
    - a. Electric lighting systems
    - b. Occupancy-sensor lighting controls
    - c. Daylighting controls
    - d. Time-of-day lighting controls
    - e. Emergency Power Systems and UPS Systems
    - f. Grounding and Bonding
    - g. Lightning Protection System
    - h. Switchgear
    - i. Utility and Pad mounted transformers
    - j. MCC's
- C. Prerequisites for Testing:
  - 1. Contractor shall certify that lighting and day lighting systems and their controls are completed, calibrated, and operating according to the Contract Documents.
  - 2. Contractor shall certify that all other electrical systems that have been identified for functional performance testing have been completed and calibrated and are operating according to the Contract Documents.

### **3.2 PREFUNCTIONAL CHECKLISTS**

- A. General:
  - 1. The checklists in this section are generally provided by the manufacturer of the equipment and submitted by the contractor to the Commissioning Provider during the construction phase. The contractor is responsible for the testing procedures and is responsible for the tests safety. These tests should be designed to assure systems readiness for the equipment provided

- B. Electric Lighting System Checklist:
  - 1. To be developed during construction phase by contractor and suppliers, reviewed and approved by the commissioning agent]
- C. Occupancy Sensor Lighting Control Checklist:
  - 1. To be developed during construction phase by contractor and suppliers, reviewed and approved by the commissioning agent
- D. Daylighting Control Checklist:
  - 1. To be developed during construction phase by contractor and suppliers, reviewed and approved by the commissioning agent]
- E. Time of Day Lighting Control Checklist
  - 1. To be developed during construction phase by contractor and suppliers, reviewed and approved by the commissioning agent
- F. Emergency Power Systems
  - 1. To be developed during construction phase by contractor and suppliers, reviewed and approved by the commissioning agent, must reflect requirements as per NFPA 110
- G. UPS Systems
  - 1. To be developed during construction phase by contractor and suppliers, reviewed and approved by the commissioning agent
- H. Grounding and Bonding
  - 1. To be developed during construction phase by contractor and suppliers, reviewed and approved by the commissioning agent
- I. Lighting Protection
  - 1. To be developed during construction phase by contractor and suppliers, reviewed and approved by the commissioning agent

### 3.3 TESTING

- A. General procedures are described in the Division 01 Section "General Commissioning Requirements."
- B. Contractor shall perform the functional performance tests described in the following sections under observation of the Commissioning Provider.
- C. The details of these functional performance tests shall be reviewed and refined during the construction phase by the Commissioning Provider.

### 3.4 ELECTRIC LIGHTING FUNCTIONAL PERFORMANCE TESTS

- A. Occupancy Sensor Lighting Controls:
  - 1. Verify 100% of occupancy sensors cover the entire space at its mounting location and adjusted angle. In addition, confirm the following for each type of occupancy sensor.

- a. Passive infra-red sensor
    - 1) Verify lens is adjusted for the space geometry and size of space.
    - 2) Verify sensitivity is adjusted for coverage of entire space.
  - b. Ultrasonic sensor:
    - 1) Verify sensitivity is adjusted for coverage of entire space.
  2. Verify sensitivity adjustment for both types of sensors does not trigger nuisance trips from air diffusers close to the sensor.
  3. Verify sensitivity adjustment eliminates trips from movement in an adjacent space
  4. After room lighting circuit is triggered on from an occupancy sensor, confirm programmed delay off time is functional. Temporarily reprogram the delay off time to expedite testing. If reprogrammed, verify final programmed delay off time matches specifications.
  5. Verify all types of sensors installed have an additional contact for use by the HVAC control system if so specified.
  6. Simulate a power failure of the lighting system to confirm power-up restart functions are operating as specified.
  7. Sampling strategy applied to all occupancy sensor issues unless noted otherwise.
    - a. Of the total controlled room lighting circuits, 10% shall be tested to confirm occupancy sensor controls. If 10% of the first group fails the test, select another 10% of the total room lighting circuits. If 10% of these rooms fail, test all remaining rooms.
- B. Electric Lighting Illumination:
1. Average light levels in the space at the work elevation shall not be less than 10% below nor greater than 30% above the specified light level range for the space.
  2. Light fixtures with dimming capability will be adjusted to maintain light levels in compliance of 3.A.4 above during the nighttime.
  3. Sampling strategy applied to all general indoor light level issues
    - a. Of the total controlled room lighting circuits, 10% should be tested to confirm proper light levels. If 10% of the first group fails the test, select another 10% of the total room lighting circuits. If 10% of these rooms fail, test all remaining rooms.
- C. Lighting Sweep Controls:
1. Either simulate sweep function by manual program initiation or by witnessing sweep function at the programmed times of occurrence. If the sweep function is simulated, verify programmed time of occurrence meets specifications by visually viewing programming screens.
  2. Verify programmed time of sweep functions meets specifications for weekdays, weekends and all holidays.
  3. Verify front-end PC and all controllers with independent time clocks are set for the correct identical time and date.
  4. Verify front-end PC security and access codes are in place.
  5. If sweep function is implemented for 10 or more independently controlled room lighting circuits with identical control hardware and software, utilize a sampling strategy to implement functional testing.
  6. Verify sweep function is operational for 50% of the room lighting circuits or a minimum of 2 circuits per controller or controlled relay.

7. Verify override function is operational by turning lights back on after a sweep with a minimum of 25% of the local override switches or 4 switches, whichever is greater.
  8. Verify 100% of the local override switches are installed and located as specified.
  9. Verify telephone and remote keypad override functions operate as specified.
  10. For the conditions, specified sequences and modes tested, the sweep controls, integral components, and related equipment respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice.
  11. Sampling strategy should be applied to all sweep functions unless noted otherwise.
    - a. Of the total controlled room lighting circuits, 10% should be tested to confirm sweep functions as listed. If 10% of the first group fails the test, select another 10% of the total room lighting circuits. If 10% of these rooms fail, test all remaining rooms.
  12. Simulate a power failure of the lighting system to confirm power-up restart functions are operating as specified.
- D. Daylighting Function:
1. Verify all space furnishings and interior finishes as being installed before functional testing or logging begins
  2. Light levels:
    - a. Light levels in the space shall meet requirements of the specification throughout the functional area of the space.
    - b. Light levels at 30 in. above finished floor (the work level) shall meet requirements as specified. If no requirements are specified, use 50 foot-candles as the suggested requirement.
    - c. Light levels on all vertical work surfaces shall meet requirements as specified. If no requirements are specified, use 15 foot-candles as the suggested requirement.
    - d. Functional area of the space will exclude a 3 foot border around the perimeter of the room.
    - e. Light levels will be measured in a 5 foot grid pattern to determine compliance with these requirements.
    - f. Sampling strategy: For rooms with identical exposures, shapes, furnishings, sources of natural and electrical lighting and daylighting controls, light levels will be evaluated in one room randomly selected.
  3. Variation in light level intensity:
    - a. Variations in light level intensity throughout the space shall conform to average to minimum ratio of 4:1 or less.
    - b. Variation in light level intensity throughout the space shall conform to maximum to minimum ratio of 8:1 or less.
    - c. Light levels will be measured in a 5 foot grid pattern to determine compliance with these requirements.
    - d. Sampling strategy: For rooms with identical exposures, shapes, furnishings, sources of natural and electrical lighting and daylighting controls, light levels will be evaluated in one room randomly selected.

E. Daylighting Control:

1. Verify all new lamps were burned in by operating at full power for a minimum of 100 hours.
2. Closed loop system – photocell measures combination of electric and natural lighting. Verify the following for 100% of the photocells;
  - a. Verify the photocell is of the closed loop type.
  - b. Verify photocell mounting location in the space and orientation is such that it measures light level typical of the space work level away from the point of natural light entry into the space.
  - c. Confirm spacer layout and material reflective properties have been finalized and remain the same after adjustment of the photocell.
3. Open loop system – photocell measures natural light level entering space. Verify the following for 100% of the photocells;
  - a. Verify photocell is of the open loop type.
  - b. Verify photocell mounting location and orientation is such that it measures natural light level entering space.
4. Verify all types of dimming light fixtures match specifications with regard to dimming ability
5. Verify all dimming light fixtures match specifications with regard to mounting locations.
6. Simulate reduced natural light levels or perform test at dawn to verify dimming fixtures are functioning. Measure amperage draw change during dimming process to confirm functionality of at least one fixture per zone.
7. Verify or adjust daytime light level setpoint to comply with item 3.A.2 above. For zones with similar geometry and natural light entry paths, replicate the calibrated setpoints in the similar zones.
8. Verify or adjust rate of change function to be not noticeable.
9. Verify 100% of dimming override location(s) to be as specified.
10. Verify dimming override feature(s) to be functional.
11. Verify dimming does not cause lower than specified light levels in adjacent “non-dimmed” spaces.
12. Verify manual dimming upper and lower limit range is set as specified.
13. Verify programmed length of override function meets specifications
14. Simulate a power failure to confirm power-up restart functions are operating as specified.
15. Sampling strategy should be applied to all daylighting functions unless noted otherwise.
  - a. Of the total controlled room lighting circuits, 10% should be tested to confirm functions as listed. If 10% of the first group fails the test, select another 10% of the total room lighting circuits. If 10% of these rooms fail, test all remaining rooms.

F. BMS integration:

1. Verify general interior zones and the designated outside lighting zones are scheduled and operating as defined by the space user or the facilities department. Verify specific requirements with current SMCCCD design standards.

**3.5 EMERGENCY POWER SYSTEMS FUNCTIONAL PERFORMANCE TESTS**

Proced. No. & Spec. Seq. ID <sup>1</sup>	Req ID No. <sup>2</sup>	Test Procedure <sup>3</sup> (including special conditions)	Expected and Actual Response <sup>4</sup> [Write ACTUAL response in brackets or circle]	Pass Y/N	Note #
<b>Initial Procedures</b>					
A		The contractor shall follow the following acceptance procedure with the engine cold and no connected load. With ATS switch in the manual position, open the ATS breaker. Restore ATS to automatic position and close ATS breaker.	Verify that power has been lost from each load served by emergency power.		
B		Connect Power Line Disturbance Monitor (PDM), Load Profiler and recording Multimeter to UPS and Backup Generator/ATS.			
<b>Generator, ATS and Loads</b>					
1		<b>Cold Start.</b> Open normal power breakers and immediately connect <u>full</u> load bank load capacity to ATS units. This connection must be made before engine generator is up to speed and transfer to E-power has been completed.	Observe the system's performance and record the following data using a Power Line Disturbance Monitor to monitor the transient responses. Compare to specifications.		
2		Measure time using PDM.	Time delay from power failure to engine start signal should be within _____ sec., [_____sec].		
3		Measure time using PDM.	Cranking time until prime-mover starts and runs should be within _____ sec., [_____sec.].		
4		Measure time using PDM.	Time until engine-generator is at proper voltage and frequency should be within _____ sec. [_____sec].		
5		Measure time using PDM.	Total time from power failure until ATS switch is on E-power should be within _____ sec., [_____sec].		
6		OPTIONAL: Repeat procedures 1-5.	Document variances from specified performance.		



Proced. No. & Spec. Seq. ID <sup>1</sup>	Req ID No. <sup>2</sup>	Test Procedure <sup>3</sup> (including special conditions)	Expected and Actual Response <sup>4</sup> [Write ACTUAL response in brackets or circle]	Pass Y/N	Note #
7		<p><b>Full Load Test.</b></p> <p>Continue generator operation. Record voltage and amperage of each phase and frequency using a load profile monitor, not generator gages; engine coolant temperature, oil pressure, and battery charge rate at 5 minute intervals for a period of one hour.</p> <p>OPTIONAL: Measure the temperature of all generator and ATS connections using a laser guided infrared temperature meter, Raytech or approved.</p>			

**Performance Criteria for Data in Table Below (by Column number).**

- |                        |  |
|------------------------|--|
| 1) 5 minute intervals  | 7) Batt. Charge: _____   |
| 2) Volts: _____        | 8) Ambient temperature: none   |
| 3) Hertz: _____        | 9) ATS Contacts Input Temp.: Note any significant variances between phases.  |
| 4) Amps: _____         | 10) ATS Contacts Output Temp.: Note any significant variances between phases |
| 5) Coolant T: _____    |  |
| 6) Oil pressure: _____ |  |

1	2	3	4	5	6	7	8	9	10	11
Time	Volts	Amps	Hertz	Engine Coolant Temp.	Oil Press	Batt. Charge	Temp. @ Gen.	Temp. @ ATS Input (list ea. phase)	Temp. @ ATS Output (list ea. phase)	Note Number

McCarthy Building

1	2	3	4	5	6	7	8	9	10	11
Time	Volts	Amps	Hertz	Engine Coolant Temp.	Oil Press	Batt. Charge	Temp. @ Gen.	Temp.@ ATS Input (list ea. phase)	Temp.@ ATS Output (list ea. phase)	Note Number

**Test Procedures Continued:**

Proced. No. & Spec. Seq. ID <sup>1</sup>	Req ID No. <sup>2</sup>	Test Procedure <sup>3</sup> (including special conditions)	Expected and Actual Response <sup>4</sup> [Write ACTUAL response in brackets or circle]	Pass Y/N	Note #
8		Disconnect load bank load from ATS, before transfer back to normal power. Restore normal power and record delay to normal power transfer.	Delay to normal power should be _____ min., [_____ min.].		
9		Record neutral delay time (if applicable) or verify in-phase monitor is working by recording voltage differential between Engine Generator Power and Utility Power at the time of the transfer back to normal power.	Neutral delay time should be _____ sec., [_____ sec.].		
10		Record engine cool-down time. (Engine continues to run after ATS transfer.)	Cool down time should be _____ min., [_____ min.].		

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Proced. No. & Spec. Seq. ID <sup>1</sup>	Req ID No. <sup>2</sup>	Test Procedure <sup>3</sup> (including special conditions)	Expected and Actual Response <sup>4</sup> [Write ACTUAL response in brackets or circle]	Pass Y/N	Note #																														
11		<p><b>Step Load Tests.</b> After the cool-down timer has expired, start the engine-generator by opening the ATS normal input power circuit breaker. With the emergency bus energized, perform the adjacent step load tests, verifying that voltage and frequency remain within specified ranges during transition and that the frequency stability (rate of change) is acceptable. Observe and record frequency and voltage response using the Powerline Disturbance Monitor.</p> <p>Tune generator governor output to meet adjacent specifications. Document.</p>	<p>Specified frequency regulation range = +/- _____ Hz Specified voltage regulation range = +/- _____ V Specified frequency stability criteria: _____.</p> <p>Max. variance of:</p> <table border="1"> <thead> <tr> <th>Step</th> <th>Volt.</th> <th>Freq.</th> <th>Stabil.</th> <th>OK</th> </tr> </thead> <tbody> <tr> <td>0-25%</td> <td>_____</td> <td>_____</td> <td>_____</td> <td>_____</td> </tr> <tr> <td>0-50%</td> <td>_____</td> <td>_____</td> <td>_____</td> <td>_____</td> </tr> <tr> <td>0-100%</td> <td>_____</td> <td>_____</td> <td>_____</td> <td>_____</td> </tr> <tr> <td>100-50%</td> <td>_____</td> <td>_____</td> <td>_____</td> <td>_____</td> </tr> <tr> <td>100-25%</td> <td>_____</td> <td>_____</td> <td>_____</td> <td>_____</td> </tr> </tbody> </table> <p>Governor tuned to meet specs.</p>	Step	Volt.	Freq.	Stabil.	OK	0-25%	_____	_____	_____	_____	0-50%	_____	_____	_____	_____	0-100%	_____	_____	_____	_____	100-50%	_____	_____	_____	_____	100-25%	_____	_____	_____	_____		
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100-25%	_____	_____	_____	_____																															
12		<p>OPTIONAL: Connect full load bank load to ATS. Maintain power flow for 15 minutes, then take temperature readings with infrared meter looking for hot spots.</p>	<p>There should be no significant variations in temperature between phases.</p> <table border="1"> <thead> <tr> <th>Point</th> <th>T1</th> <th>T2</th> <th>T3</th> </tr> </thead> <tbody> <tr> <td>_____</td> <td>_____</td> <td>_____</td> <td>_____</td> </tr> </tbody> </table>	Point	T1	T2	T3	_____	_____	_____	_____																								
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_____	_____	_____	_____																																
13		<p>OPTIONAL: Transfer load back to utility source. Maintain power flow for 15 minutes and take temperature readings with infrared meter looking for hot spots.</p>	<p>There should be no significant variations in temperature between phases.</p> <table border="1"> <thead> <tr> <th>Point</th> <th>T1</th> <th>T2</th> <th>T3</th> </tr> </thead> <tbody> <tr> <td>_____</td> <td>_____</td> <td>_____</td> <td>_____</td> </tr> </tbody> </table>	Point	T1	T2	T3	_____	_____	_____	_____																								
Point	T1	T2	T3																																
_____	_____	_____	_____																																
14		<p><b>ATS TEST SWITCH.</b> Operate the ATS test switch and verify that the generator starts and the E-Power sequence is initiated. (Bypass the return to normal timer to accelerate the test sequence.)</p>	<p>Generator should start and E-power sequence initiated. Verify that total time to E-power meets that specified (see Procedure 5).</p>																																
15		<p>OPTIONAL: Safety interlocking will be demonstrated by trying to operate the ATS and controls in a deranged manner, if possible.</p>	<p>Alarms should be generated and E-power system go or remain off-line.</p>																																

Proced. No. & Spec. Seq. ID <sup>1</sup>	Req ID No. <sup>2</sup>	Test Procedure <sup>3</sup> (including special conditions)	Expected and Actual Response <sup>4</sup> [Write ACTUAL response in brackets or circle]	Pass Y/N	Note #
16		a) Simulate all alarms, alarm contact operation and remote enunciator operation by jumping across alarm contacts at ATS and generator. b) Verify any alarms to the BAS or other remote monitoring sites.	a) All alarms are properly annunciated in the remote panel.  b) Alarms received by BAS and remote sites.		
17		Check calibration of ATS digital readouts of frequency, current and volts against a calibrated instrument.	ATS values should be within the following tolerances: Hz: _____ [_____] Amps: _____ [_____] Volts: _____ [_____]		
<b>UPS and Integrated Building Test</b>					
18		Prepare to operate all facility loads connected to the backup power system, including UPS loads. Connect load profiler to generator system. Begin operating as many of the emergency loads as possible (both UPS and other). (If UPS loads cannot be tested live, install a full load bank on the UPS.)  With ATS, generator and UPS in normal auto mode, cut power to emergency loads. Do not load bank generator.	Observe the generator start and ATS switch to generator power.		
19		With the generator providing power for actual building loads, tune generator governor output to meet adjacent specifications and for optimal compatibility with UPS. Document results..	Specified frequency regulation range = +/- _____ Hz Specified voltage regulation range = +/- _____ V Specified frequency stability criteria: _____.  Final max. variance during building test: Volt.      Freq.      Stabil. OK _____      _____ _____      _____  Governor tuned to meet specs.		

Proced. No. & Spec. Seq. ID <sup>1</sup>	Req ID No. <sup>2</sup>	Test Procedure <sup>3</sup> (including special conditions)	Expected and Actual Response <sup>4</sup> [Write ACTUAL response in brackets or circle]	Pass Y/N	Note #
20		<b>UPS</b> Connect load profiler to UPS and monitor the UPS load voltage, frequency and amperage with load profiler, through transition (dynamic) and at steady state.	Verify UPS goes back to generator power (off battery and stays off), per spec. Verify that specified voltage dynamic regulation is met: Dynamic voltage overshoot should be within _____; Actual: _____. Steady-state voltage variation should be within +/-2%; Actual: _____ Frequency overshoot should be within _____; Actual: _____ THD should be less than 5%. Wave form deviation should be minimal.		
20a		Measure the amperage of each phase off the UPS. Verify that they are balanced.	Phase A = [ _____ ] Phase B = [ _____ ] Phase C = [ _____ ] Phase imbalance is within ____%?		
21		Tune UPS opening and closing of frequency window and slew rate.	UPS tuned.		
22		Simulate all alarms, alarm contact operation and remote enunciator operation by jumping across alarms. List.	All alarms are properly annunciated.		
23		Change ATS to manual and cut emergency power to UPS. Monitor UPS. Allow batteries to drain 25% or more.	Observe that loaded UPS provides sufficient power.		
24		Restore emergency power to UPS.	Verify that UPS is charging properly from the generator.		
25		Verify function of UPS bypasses.	Bypasses function per spec.		
26		Check calibration of UPS digital readouts of frequency, current and volts against a calibrated instrument.	UPS values should be within the following tolerances: Hz: _____ [ _____ ] Amps: _____ [ _____ ] Volts: _____ [ _____ ]		

Proced. No. & Spec. Seq. ID <sup>1</sup>	Req ID No. <sup>2</sup>	Test Procedure <sup>3</sup> (including special conditions)	Expected and Actual Response <sup>4</sup> [Write ACTUAL response in brackets or circle]	Pass Y/N	Note #				
27		<p><b>Building Test</b></p> <p>Continuing from above, with generator, ATS and UPS in auto and E-power circuit open, test the function of all loads on emergency power, including UPS loads.</p> <p>Verify that proper power is delivered to each device listed in the emergency panel schedules and that equipment directly wired functions properly.</p> <p>Monitor generator output manually every 15 minutes (voltage, amperage, frequency).</p>	<p>Generator should be running at less than 100% load, [_____ %].</p> <p>UPS loads should properly operate from generator and not transfer to battery power.</p> <p>Generator</p> <table border="0"> <tr> <td><u>Time</u></td> <td><u>Volts</u></td> <td><u>Amps</u></td> <td><u>Hz</u></td> </tr> </table>	<u>Time</u>	<u>Volts</u>	<u>Amps</u>	<u>Hz</u>		
<u>Time</u>	<u>Volts</u>	<u>Amps</u>	<u>Hz</u>						
28		Walk through building and observe that all emergency lighting is ON. Compare and reconcile with the prints, any areas that are unusually dark.	All loads are properly serviced with power. Full listing and check off is attached.						
29		Using the emergency panel schedule, verify that any specialty emergency lighting is ON (oral surgery, telecom, engineer's room, electrical room, 2nd floor procedure room lights, elevators).	All loads are properly serviced with power. Full listing and check off is attached.						
30		Go to each emergency power receptacle and verify proper power.	OK?						
31		Go to each specialty load on emergency power and verify proper power and function:							
31a		a. Security panel. Verify that it is functioning by heating the Security Co. stat in the Telecom room above its alarm setpoint (____80F) and having Security Co. fax the printout of the trouble report.	OK?						
31b		b. Fire alarm panel. Verify that it is functioning by initiating an alarm and then resetting.	OK?						
31c		c. Med-gas alarm. Derange the system and verify that an alarm was initiated.	OK?						
31d		d. Dental chairs in rms. Verify power to their outlets or try some functions.	OK?						

Proced. No. & Spec. Seq. ID <sup>1</sup>	Req ID No. <sup>2</sup>	Test Procedure <sup>3</sup> (including special conditions)	Expected and Actual Response <sup>4</sup> [Write ACTUAL response in brackets or circle]	Pass Y/N	Note #
31e		e. <u>Telecom HVAC.</u> Using a heat gun, increase the temperature at the FCU-2 stat 5F above its setpoint ( ____ 77F). Observe FCU-2 and ACU-1 start and deliver cool air to the room. Remove heat and observe units cycle OFF.	OK?		
31f		f. <u>Telecom System.</u> Verify that telecom loads are functioning properly under emergency power (unless UPS had to be load banked).	OK?		
31g		g. <u>Elevator.</u> Test the elevator recall function under emergency power.	Elevator recalls per specified sequences.		
32		<u>UPS Monitored Alarms.</u> The following alarms are monitored by the Security Co. Verify their function by causing the alarm, recording the time and having Security Co. fax a copy of the alarm report. a) Electrical failure. Simulate an electrical failure or malfunction. b) Detection of power being switched to the UPS. Verify during one of the previous transfers. c) Low Battery. Simulate a low battery condition. d) Space temperature above alarm setpoint. Heat stat above setpoint.	OK?		

Proced. No. & Spec. Seq. ID <sup>1</sup>	Req ID No. <sup>2</sup>	Test Procedure <sup>3</sup> (including special conditions)	Expected and Actual Response <sup>4</sup> [Write ACTUAL response in brackets or circle]	Pass Y/N	Note #
33		As necessary, provide any attachments and a written report beyond this test form comparing measurement data with factory and project specifications, in areas that do not comply or where additional documentation or explanation is necessary.			
34	--	<b>Return all changed control parameters and conditions to their pre-test values<sup>5</sup></b>			

<sup>1</sup>Sequences of operation attached to this test.

<sup>2</sup>Mode or function ID being tested from testing requirements section of the project Specifications.

<sup>3</sup>Step-by-step procedures for manual testing, trend logging or data-logger monitoring.

<sup>4</sup>Include tolerances for a passing condition. Fill-in spaces or lines not in brackets denote sequence parameters still to be specified by the A/E, controls contractor or vendor. Write "Via BAS" for verifications of device position from BAS readout or "Via obs" for actual observation or from test instrument reading.

<sup>5</sup>Record any permanently changed parameter values and submit changes to Owner.

**COMMISSIONING OF ELECTRICAL SYSTEMS**

**3.6 GROUNDING AND BONDING FUNCTIONAL PERFORMANCE TESTS**

- A. All work to be performed according to 26 05 26, Grounding and Bonding, of the project specifications.
  - 1. Provide a test report that complies with 26 05 26 (Grounding and Bonding) paragraph 3.10.
  - 2. Warranty and Operations:
    - a. Provide project specific post construction inspections manual to the owner that includes type of recommend periodic inspections, tests and their frequency.

**3.7 LIGHTNING PROTECTION FUNCTIONAL PERFORMANCE TESTS**

- A. All work to be performed according to NFPA 780 guidelines and section 26 41 13, lightning protection, of the project specifications:
- B. The contractor is to provide and execute the proposed tests. As a minimum the test shall include the installation verifications for all critical elements such as:
  - 1. Verify zone of protection based on 150-ft "Rolling Sphere Model"
  - 2. Air Terminal placement and installation requirements
  - 3. "Downcomers"
    - a. Verify sufficient number and sizing
    - b. Note Installation compliance and locations
  - 4. Ground Rod & Test Wells
    - a. Note Installation compliance and locations
    - b. Measure and verify the ground resistance in accordance with 26 05 26 (Grounding and Bonding)
  - 5. Continuity
    - a. Verify continuity from each air terminal to ground rod
    - b. Physical inspection of all mechanical connections for the system.
  - 6. Warranty and Operations
    - a. Provide project specific post construction inspections manual to the owner that includes type of recommend periodic inspections and test and their frequency.

**- END OF SECTION -**





**- SECTION 26 0805 -**

**ELECTRICAL ACCEPTANCE TESTING**

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**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Testing, evaluation and calibration of equipment provided, installed and connected in Division 26.
  - 2. Evaluation of connection and normal operation of utilization equipment, provided in other Divisions, for installation and connection in Division 26.

**1.2 REFERENCES**

- A. Acceptance Testing Criteria: Latest edition of Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems, published by IETA.
- B. Applicable Codes, Standards and References:
  - 1. California Electrical Code (CEC).
  - 2. National Electrical Manufacturer's Association (NEMA).
  - 3. American Society for Testing and Materials (ASTM).
  - 4. Institute of Electrical and Electronic Engineers (IEEE).
  - 5. International Electrical Testing Association (IETA).
  - 6. American National Standards Institute (ANSI).
  - 7. State and local codes and ordinances.
  - 8. Insulated Power Cable Engineers Association (IPCEA).
  - 9. Association of Edison Illuminating Companies (AEIC).
  - 10. OSHA Part 1910; Subpart S, 1910.308.
  - 11. National Fire Protection Association (NFPA).

**1.3 SYSTEM DESCRIPTION**

- A. Performance Requirements:
  - 1. Retain the services of a recognized independent testing firm for the purpose of performing inspections and tests as specified herein.
  - 2. Independent test firm providing report direct to CP or owners representative.
  - 3. Material, equipment, labor and technical supervision to perform tests and inspections provided by testing firm.

4. It is the intent of these tests to assure that electrical equipment, Contractor or Owner supplied, is operational within industry and manufacturer's tolerances and is installed in accordance with design Specifications.
5. Tests and inspections determine suitability for energization.
6. Supply to the independent testing organization complete sets of approved shop drawings, coordination study (provided by Contractor's equipment supplier under Contractor's direction, setting of adjustable devices and other information requested by testing agency).

B. Scope of Testing, Evaluation and Calibration:

1. Power transformers.
2. Distribution transformers.
3. Low voltage circuit breakers (greater than 100 amp).
4. Medium voltage circuit breakers.
5. Switchboards.
6. Ground fault protective signaling.
7. Protective relays and associated instrument transformers.
8. Medium voltage cables.
9. Grounding systems and Lightning Protection.
10. Motor control centers.
11. Generators and UPS systems used for Life Safety, see also 26 08 00
12. Lighting system see 26 08 00 specification

#### 1.4 SUBMITTALS

A. Test Reports:

1. Maintain written record of tests.
2. At completion of project, assemble and certify a final test report. Submit report to CP prior to final acceptance to include:
  - a. Summary of project.
  - b. Description of equipment tested.
  - c. Visual inspection report.
  - d. Description of tests.
  - e. Test results.
  - f. Conclusions and recommendations.
3. Provide all proposed tests during the submittal phase of construction for approval to the CP.

#### 1.5 QUALITY ASSURANCE

A. Qualifications of Testing Firm:

1. Corporately independent testing organization which can function as an unbiased testing authority, professionally independent of the manufacturers, suppliers and installers of equipment or systems evaluated by testing firms.
2. Independent organization as defined by OSHA Title 29, Part 1936 and IETA.

3. Regularly engaged in the testing of electrical materials, devices, appliances, electrical installations and systems for the purpose of preventing injury to persons or damage to property and other equipment.
4. Engaged in testing practices for minimum of 2 years.
5. Use only full-time technicians, regularly employed by firm for testing services. Electrically unskilled employees are not permitted to perform testing or assistance of any kind. Electricians and line workers may assist, but may not perform testing or inspection services.
6. Submit proof of above qualifications with Bid Documents.

B. Certifications:

1. Comply with OSHA criteria for accreditation of testing laboratories, Title 29, Parts 1907, 1910 and 1936. Full membership in the IETA constitutes proof of such criteria.
2. Lead, on site, technical person currently certified by IETA in Electrical Power Distribution System Testing.
3. Instruments used by testing firm to evaluate electrical performance meet IETA Specifications for Test Instruments.

## **PART 2 - PRODUCTS (NOT USED)**

## **PART 3 - EXECUTION**

### **3.1 FIELD QUALITY CONTROL**

A. Tests:

1. Contractor's Responsibilities:
  - a. Perform routine insulation resistance, continuity and rotation tests for distribution and utilization equipment prior to and in addition to tests performed by testing firm.
  - b. Notify the testing firm when equipment becomes available for acceptance tests. Coordinate work to expedite project scheduling.
2. Testing Firm's Responsibilities:
  - a. Notify Architect prior to commencement of any testing.
  - b. Report directly to Architect any systems, material or installation found defective on the basis of acceptance tests.
  - c. Provide auxiliary portable power supply necessary for conducting tests.
  - d. Firm shall perform all pre-functional performance tests with the tests approved by the Commissioning Provider. The CP and the owner shall be advised of all tests as required by the general commissioning requirements in 01 91 00.
  - e. Firm shall assist in performing all following functional performance tests conducted by the Commissioning Provider.

**3.2 ADJUSTING**

- A. Final Settings: Testing firm responsible for implementing final settings and adjustments on protective devices and tap changes in accordance with Architect's specified values.

**- END OF SECTION -**

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**- SECTION 26 0923 -****LIGHTING CONTROL DEVICES**

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**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.

**PART 2 - PRODUCTS**

- A. Time Switches: Electronic, solid-state programmable units, with multiple channels.
- B. Outdoor Photoelectric Switches: Solid state, with dry contacts, adjustable 30-second time delay.
- C. Indoor Photoelectric Switches: Ceiling-mounting units; solid-state, light-level sensor with separate relay mounted on luminaire.
  - 1. Continuous Dimming Daylighting Controller: Provide dimming control systems capable of controlling 10VDC control input fluorescent dimming ballasts in three output zones via one photocell, with system adjustments capable of being made at control module instead of remote photocell.
  - 2. Switched Daylighting Controller: Provide switched control systems capable of controlling three output zones via one photocell with system adjustments capable of being made at control module instead of remote photocell.
  - 3. Local Continuous Dimming Photocell: Provide local daylighting photocell capable of directly controlling up to fifty 10VDC control input fluorescent dimming ballasts.
  - 4. Local Switched Photocell: interfaces with room occupancy sensor power pack, where available.
  - 5. HID High/Low Ballast Switching: Provide HID bi-level HID controller for each HID luminaire in switched daylighting control area. Controller to contain both capacitor and control module, allowing HID ballast to be switched to 50 percent of full power output based on 24VDC control signal.
- D. Indoor Occupancy Sensors:
  - 1. Occupancy Sensors:
    - a. Passive Infrared Sensors: a. Sensor Function: Detects human presence in the floor area being controlled by detecting changes in the Infrared energy. Sensor detects small movements, i.e., when a person is writing while seated at a desk.

- b. Ultrasonic Occupancy Sensors: a. Sensor Function: Detects human presence in the controlled floor area by detecting Doppler shifts in 40kHz ultrasound created by sensor.
- c. Dual Technology Sensors: a. General: Sensor has combined capability of passive infrared and ultrasonic sensors as described above.
- 2. Combined Occupancy Sensor/Wall Switches ("Sensor Switches"):
  - a. Completely self-contained sensor system that fits into a standard single gang box. Internal transformer power supply, latching dry contact relay switching mechanism compatible with electronic ballasts, compact fluorescent, and inductive loads. Triac and other harmonic generating devices are not allowed.
- 3. The detector shall have field adjustable time delay settings from 30 seconds to 30 minutes.
- 4. Factory set sensors for maximum sensitivity.
- 5. LED lamp built into sensor indicates when occupant is detected.
- 6. Provide power packs for the sensor to control the number of circuits and/or switch legs within its area of coverage.
- 7. Field set time delay for each device as noted below:
  - a. Classrooms and Conference Rooms: 15 minutes.
  - b. Restrooms: 15 minutes. 30 minutes if interlocked with the exhaust fan.
  - c. Storage Rooms, Janitor's Closets, Single Stall Restrooms: 5 minutes.
  - d. Offices: 15 minutes.
  - e. All Other Spaces: 15 minutes.
  - f. Timer Switches: 2 hours.
- E. Outdoor Motion Sensors: Individually mounted fixture and individually mounted for operation in temperatures form minus 10 to plus 130 deg F.
- F. Lighting Contactors: Electrically operated and mechanically or electrically held.
- G. Emergency Shunt Relay: Normally closed, electrically held, arranged for wiring in parallel with manual or automatic switching contacts.
- H. Control Cables:
  - 1. Power Cables: Not smaller than No. 12 AWG.
  - 2. Classes 2 and 3 Control Cables: Stranded-copper conductors, not smaller than No. 22 AWG
  - 3. Class 1 Control Cables: Stranded-copper conductors, not smaller than No. 18 AWG.

**- END OF SECTION -**

**- SECTION 26 0933 -**

**CENTRAL DIMMING CONTROLS**

---

**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 WARRANTY**

- A. Materials and Workmanship
  - 1. One year.

**1.3 SYSTEM DESCRIPTION**

- A. Microprocessor-based , solid-state controls consisting of master control station(s), wall stations, and separately mounted dimmer panels.
- B. Operation: Slider.
- C. Each zone shall be configurable to control the following light sources:
  - 1. Fluorescent lamps with electronic ballasts.
  - 2. Line-voltage incandescent lamps.
  - 3. Low-voltage incandescent lamps.
  - 4. Cold cathode lamps.
  - 5. Non-dimmed loads.
  - 6. LED lamps.
- D. Control of each zone shall interface with controls for the following accessory functions:
  - 1. Curtains and drapes.
  - 2. Blackout curtains.
  - 3. Projector screens.
  - 4. MotORIZED partitions.
  - 5. Manually positioned partitions.
- E. Memory: Retain settings through power failures for at least 90 days.
- F. Control Network: 24- or 10-V dc.



## 1.4 CONTROL STATIONS

- A. Master-Control Station: Digital rocker switches with LCD graphic display of light level.
  - 1. Master channel shall raise and lower lighting level of all zones.
  - 2. Fade rate adjustable from zero to 60 seconds.
  - 3. Emergency-control pushbutton to buypass all controls.
  - 4. Housekeeping controls.
  - 5. Pushbuttons for accessory functions.
  - 6. Enable and disable wall stations.
  - 7. Communications link to other master stations.
  - 8. Portable computer connections for master control station.
  - 9. Rear-illuminate all scene-select buttons.
  - 10. Show lighting-level setting and fade-rate setting graphically.
  
- B. Partitioned-Space Master-Control Station: Automatically combine and separate lighting and accessory function controls as spaces are configured with movable partitions.
  - 1. Master controls for partitioning spce into six adjacent rooms.
  - 2. Manual controls to set up six scenes from wall stations in each room.
  - 3. Master channel to raise and lower light level in all zones.
  - 4. Zero to 60 second adjustable fade rate.
  - 5. Fade override for each scene.
  - 6. On and off scene controls for non-dim channel contactors.
  - 7. Emergency control pushbutton.
  - 8. Master on and off switch.
  - 9. Housekeeping controls.
  - 10. Pushbuttons foe accessories functions.
  - 11. Portable computer connections for master control station.
  - 12. Rear illuminated scene-selection buttons.
  - 13. LED or backlighted bar-graph indicators for lighting level and fade rate.
  
- C. Custom graphics for display of room configurations.
  
- D. Mounting: Single, flush wall box with manufacturer's faceplate with hinged transparent locking cover.
  
- E. Wall Stations: Submaster to a master station, containing limited control of selected scenes.
  - 1. Control to adjust lighting level of each dimmer for each scene, and the fade-time setting of each scene.
  - 2. Numbered pushbuttons to select scenes.
  - 3. Off switch to turn master station off. Operating the off switch at any remote station automatically turns on selected housekeeping lighting.
  - 4. On switch turns all scenes of master station to full bright.
  - 5. Pushbutton controls for accessory functions.

- F. Dimmer Cabinets: Factory wired, conventioncooled without fans, with barriers to accommodate 120- and 277-V feeders and suitable to control desinated lighting eqiupment or accessory functions.
1. Cabinet Type: Plug in, modular.
  2. Ambient Conditions:
    - a. Temperature: 60 to 95 deg F (15 to 35 deg C).
    - b. Relative Humidity: 10 to 90 percent, noncondensing.
    - c. Filtered air supply.
  3. Lighting Dimmers: Solid-state SCR dimmers.
    - a. Dimming Range: 0 to 100 percent, full output voltage not less than 98 percent of line voltage.
    - b. Protect controls of each dimmer with a fusel and transient voltage surge suppression.
  4. Non-dim modules.
  5. Digital control network.
  6. Emergency Power Transfer Switch: Transfer load circuits form normal to emergency power supply when mormal supply fails.
- G. Portable computer to program master station and associated wall stations, and all interconnected master stations with software configured and customized by master-station manufacturer.
- H. Manual switches and plates.
- I. Conductors and Cables:
1. Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No.12 AWG.
  2. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 24 AWG.
  3. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG.
  4. Unshielded, Twisted-Pair Data Cable: Category 5e.

**- END OF SECTION -**



**- SECTION 26 0943 -**

**NETWORK LIGHTING CONTROLS**

---

**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. Manually operated lighting controls with relays electrically operated circuit breakers and module.
  - 1. Manually operated, digital lighting controls with external signal source, relays, electrically operated circuit breakers, and control module.
  - 2. Individually addressable lighting control devices communicating with data-entry and – retrieval devices using DALI protocol.

**1.3 QUALITY ASSURANCE**

- A. Quality Standard: 47 CFR, Subparts A and B, Class A.

**1.4 WARRANTY**

- A. Materials and Workmanship one year.
- B. Software Upgrades: Materials, workmanship, and programming for two years.

**1.5 SOFTWARE SERVICE AGREEMENT**

- A. Software technical support and upgrade services for two years.

**PART 2 - PRODUCTS**

**2.1 EXPANDABILITY:**

- A. Capable of increasing capacity by 25 percent of current capacity.

**2.2 PERFORMANCE REQUIREMENTS:**

- A. Manual operation of switches signals relays or electrically operated circuit breakers through programmable control module.
- B. Manual operation, internal timing and control unit, or an external source signals relays or electrically operated circuit breakers through progemmable control module.
- C. Individually addressable devices communicating with data-entry and retrieval devices using DALI protocol.

**2.3 CONTROL MODULE:**

- A. Microprocessor-based, solid-state, 365-day timing and control unit; pilot-duty, relay-type output circuit; integral and alphanumeric LCD or LED display.
- B. Microprocessor-based, solid-state, 365-day timing and control unit; pilot-duty, relay-type output circuits; intergral keypad and alphanumeric LCD display.
- C. Microprocessor-based, solid-state, 365-day control unit that receives programming form hand-held programmer; pilot-duty output circuits; and integral keypad.
- D. Panelboard-mounted, microprocessor-based, solid-state, 365-day control unit; and branch circuit breakers as power-circuit switching devices.
- E. Programmable, microprocessor-based control unit mounted in pressembled moduar relay panel; and lighting circuit relays as output circuit devices.
- F. Programmable, PC-based control unit with keyboard and color LCD for separate graphic display(s) for programming lighting control panelboard; interoperable with building automation system.
- G. Features:
  - 1. Interoperability: Lonworks or BACnet network.
  - 2. Nonvolatile system memory.
  - 3. Lighting control software.
  - 4. Automatic time adjustment.
  - 5. Astronomic control.
  - 6. Demand control.
  - 7. On-off confirmation signal.
  - 8. Remote communication capability.
  - 9. Telephone override capability.
  - 10. Load override capability.
  - 11. Automatic control of local override.
  - 12. Automatic battery backup.
  - 13. Programmed time signal.
  - 14. Daylight balancing dimming control.
  - 15. Daylight compensating switch control.

16. Bilevel controls.
17. Flick warning.
18. Diagnostics.
19. Local data-entry devices: PC, PDAs, hand-held IR devices, and wired or wireless Ethernet hubs.

H. Power Distribution Component modular

I. Manual Switches:

1. Momentary contact, low-voltage push buttons and maintained contact, full or low-voltage switches, with integral pilot light; finish plates and legends.

J. Conductors and Cables

1. No. 12 AWG power wiring to supply side of Class 2 power source.
2. Classes 2 and 3 Control Cable: Multiconductor cable with copper conductors.
3. Class 1 Control Cable: Multiconductor cable with copper conductors.
4. Digital and Multiplexed Signal Wire: Unshielded, Category 5e twisted-pair cable.

**2.4 INSTALLATION:**

A. Wiring Method:

1. In raceways except in accessible ceiling space and gypsum board partitions.

B. Field-mounted transient voltage suppressors for lighting control devices installed in Category A locations that do not have integral line-voltage surge protection.

C. Software installation and user-variable programming.

**- END OF SECTION -**



## - SECTION 26 1116 -

# SECONDARY UNIT SUBSTATIONS

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## 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. Indoor and outdoor secondary unit substations, each consisting of incoming section, transformer, and secondary distribution section.

### 1.3 QUALITY ASSURANCE

- A. Quality Standards:
  - 1. IEEE C2 and IEEE C37.121.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURED UNITS:

- A. Indoor Unit Arrangement: Single assembly equipment connected with busway.
- B. Outdoor Unit Arrangement:
  - 1. Single assembly, aisleless construction.
- C. Primary Incoming Section:
  - 1. Enclosed, air-interrupter, primary switch.
  - 2. Surge Arresters: Distribution class.
- D. Dry-Type Transformer Section:
  - 1. Enclosure:
    - a. Indoor, ventilated vacuum-pressure, impregnated type.
    - b. Cooling System:
      - 1) Class AA, air cooled.
  - 2. Insulation Class:



- a. 220 deg C.
- 3. Insulation Temperature Rise:
  - a. 115 deg C, maximum rise above 40 deg C.
- 4. Basic Impulse Level:
  - a. 95 kV.
- 5. Full-Capacity Voltage Taps:
  - a. Four nominal 2.5 percent taps, 2 above and 2 below rated primary voltage.
- E. Secondary Distribution Section:
  - 1. Low-voltage switchboard.
    - a. Network switchgear-mounted disconnect switch.

## **PART 3 - EXECUTION**

### **3.1 SOURCE QUALITY CONTROL:**

- A. Transformers:
  - 1. Tested and inspected according to IEEE C57.12.90.
- B. Switchgear and Switchboards:
  - 1. Tested and inspected according to ANSI C37.51.

### **3.2 FIELD QUALITY CONTROL:**

- A. Testing:
  - 1. By Contractor-engaged agency or Contractor.

**- END OF SECTION -**

## **- SECTION 26 2200 -**

# **LOW-VOLTAGE TRANSFORMERS**

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## **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. Dry-type, distribution transformers rated 600V and less, with capacities up to 1000 kVA.

### **1.3 QUALITY ASSURANCE**

- A. Quality Standard:
  - 1. IEEE C57.12.91.

### **1.4 WARRANTY**

- A. Comply with provisions of Section 01740.
- B. Provide warranty for completed installation signed by manufacturer, applicator and Contractor warranting against water infiltration and chloride ion penetration into concrete including defects of materials and workmanship for period of 5 years from date of Substantial Completion.
  - 1. Warranty shall include labor for reapplication of material.

## **PART 2 - PRODUCTS**

- A. General Transformer Requirements:
  - 1. Factory assembled and tested; air cooled.
  - 2. Cores: Grain-oriented, non-aging silicon steel.
  - 3. Coils: Copper, continuous windings without splices except for taps.
- B. Distribution Transformers:
  - 1. NEMA ST 20.
    - a. Core:
      - 1) One leg per phase.

2. Enclosure:
    - a. Ventilated.
    - b. NEMA 250, Type 2.
  3. Custom Finish: Gray.
  4. Taps for Transformers Smaller Than 3 kVA: None.
  5. Taps for Transformers 7.5 to 24 kVA: One 5 percent tap above and one 5 percent below normal full capacity.
  6. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent below normal full capacity.
  7. Insulation Class: 220 deg C, with maximum 115 deg C rise above 40 degC.
  8. Features:
    - a. Energy efficient for transformers larger than 15 kVA.
    - b. K-factor rating: K13 rated where the transformer serves computer classrooms.
    - c. Electrostatic shielding.
    - d. Wall brackets.
    - e. Fungus proofing.
    - f. Low sound level.
    - g. TP-1 rated
- C. Buch-Boost Transformers: Self-cooled, two-winding dry type with ventilated enclosure.
1. Finish: Gray.

## **PART 3 - EXECUTION**

### **3.1 SOURCE QUALITY CONTROL**

- A. Transformers: Tested and inspected according to IEEE C57.12.91.

### **3.2 FIELD QUALITY CONTROL:**

- A. Testing: By Contractor-engaged agency or Contractor.
- B. Test Procedure:
  1. Visual and mechanical inspections and electrical tests.
  2. Infrared scanning.

**- END OF SECTION -**

## **- SECTION 26 2300 -**

# **LOW-VOLTAGE SWITCHGEAR**

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## **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. Metal-enclosed, low-voltage, power circuit-breaker switchgear rated 1000V and less for use in ac systems

## **PART 2 - PRODUCTS**

- A. Ratings:
  - 1. Nominal System Voltage: 480 V, 3P 480/277V, 4 wire, 60 Hz.
  - 2. Main-Bus Continuous: As required or indicated.
- B. Fabrication:
  - 1. Factory assembled and tested and complying with IEEE C37.20.1.
- C. Indoor Enclosure: Steel.
- D. Outdoor Enclosure: Galvanized steel.
  - 1. Space heater.
  - 2. Louvers for circulation.
  - 3. Hinged front door, interior light and duplex receptacle.
  - 4. Weatherproof internal aisle construction, with access doors, space heaters, lights, and duplex receptacles
- E. Section barriers between main and tie circuit-breaker compartments.
- F. Bus isolation barriers.
- G. Circuit-breaker compartments.
- H. Removable, hinged, rear cover panels.

- I. Auxiliary Compartments:
  - 1. Utility metering compartments.
  - 2. Bus transition sections.
  - 3. Incoming-line pull sections.
  - 4. Hinged front panels.
  - 5. Pull box on top of switchgear.
  
- J. Bus bars connect between vertical sections and between compartments.
  - 1. Neutral Bus: 100 percent of phase-bus ampacity.
  - 2. Phase and Neutral Bus: Plated Cooper.
  - 3. Copper ground bus.
  - 4. Bus-bar insulation.

## 2.2 COMPONENTS:

- A. Instrument Transformers:
  - 1. Potential transformers.
  - 2. Current transformers.
  
- B. Instruments: Multifunction digital-metering monitor.
  
- C. Relays.
  
- D. Surge arresters.
  
- E. Control Power Supply: Dry-type transformer, 120V.
  
- F. Circuit Breakers:
  - 1. Operating Mechanism: Mechanically and electrically trip-free, stored-energy type.
    - a. Normal closing speed.
    - b. Slow closing speed.
    - c. Stored-Energy Mechanism: Manually charged.
    - d. Operation counter.
  - 2. Solid-state trip devices.
  - 3. Auxiliary contacts.
  - 4. Padlocking provisions.
  - 5. Operating handle.
  - 6. Electric close button.
  - 7. Mechanical interlocking.
  - 8. Key interlocks.
  - 9. Undervoltage Trip Devices: Adjustable.
  - 10. Shunt-trip devices.
  - 11. Fused circuit breakers.

## LOW-VOLTAGE SWITCHGEAR

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- 12. Indicating lights
- G. Spare-fuse cabinet.
- H. Identification: Mimic bus.

## **PART 3 - EXECUTION**

### **3.1 FIELD QUALITY CONTROL:**

- A. Testing: By Contractor-engaged agency or Contractor.

**- END OF SECTION -**



## - SECTION 26 2413 -

# SWITCHBOARD

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### **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 QUALITY ASSURANCE**

- A. Quality Standards:
  - 1. NEMA PB 2, NFPA 70, and UL 89

### **PART 2 - PRODUCTS**

- A. Manufactured Units:
  - 1. Front-connected, front-accessible switchboards.
    - a. Main Devices: Panel or Fixed and individually mounted.
    - b. Branch Devices: Panel mounted.
    - c. Sections front and rear aligned.
  - 2. Front- and side-accessible switchboards.
    - a. Main Devices: Fixed, individually mounted.
    - b. Branch Devices: Panel mounted.
    - c. Sections front and rear aligned.
  - 3. Front- and rear-accessible switchboards.
    - a. Main Devices: Fixed, individually and Drawout mounted.
    - b. Branch Devices: Panel or Fixed and individually mounted.
    - c. Sections front and rear aligned.
  - 4. Nominal System Voltage: 480Y/277 V or 208Y/120 V.
  - 5. Main-Bus Continuous: as specified or indicated.
  - 6. Constructed to withstand seismic forces.
  - 7. Indoor Enclosures: Steel, NEMA 250, Type 1.
    - a. Finish: Standard gray color.
    - b. Walk-in aisle heating and ventilating.
  - 8. Barriers: Between adjacent switchboard sections.



9. Insulation and Isolation: Main bus of main section and main and vertical buses of feeder sections.
  10. Cubical space heaters.
  11. Utility metering compartment.
  12. Customer metering compartment.
  13. Bus transition and incoming pull sections.
  14. Removable, hinged rear doors and compartment covers.
  15. Hinged front panels.
  16. Pull box on top of switchboard.
  17. Buses and Connections: Three phase, four wire; coated copper.
  18. Future device provisions.
  19. Bus-bar insulation.
- B. Disconnecting and Overcurrent Protective Devices:
1. Molded-case circuit breaker (MCCB), with interrupting capacity to meet available fault currents.
    - a. Thermal-magnetic circuit breakers.
    - b. Adjustable instantaneous-trip circuit breakers.
    - c. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and field-adjustable settings.
    - d. Current-limiting circuit breakers.
    - e. Integrally fused circuit breakers.
    - f. Accessories:
      - 1) Lugs: Mechanical style.
      - 2) Ground-Fault Protection: Integrally mounted.
      - 3) Zone-selective interlocking.
      - 4) Communication Capability: Circuit-breaker-mounted communication module.
      - 5) Shunt trip.
      - 6) Undervoltage trip.
      - 7) Auxiliary Contacts: as designed.
      - 8) Key interlock kit.
- C. Insulated-Case Circuit Breaker (ICCB): 80 percent rated, fixed mounting.
1. Two-step, stored-energy closing.
  2. Standard- function microprocessor-based trip units.
  3. Zone-selective interlocking.
  4. Remote trip indication and control.
  5. Communication capability.
  6. Key interlock kit.
  7. Control Voltage: 120-V ac.

- D. Instrumentation:
1. Instrument Transformers:
    - a. Potential transformers.
    - b. Current transformers.
    - c. Control-power transformers.
    - d. Current transformers for neutral and ground-fault current sensing.
  2. Multifunction digital-metering monitor.
  3. Ammeters, voltmeters, and power-factor meters.
  4. Instrument switches.
  5. Feeder ammeters.
  6. Watt-hour meters and wattmeters.
  7. Impulse-totalizing demand meter.
- E. Control Power: 120-V ac.
- F. Accessories:
1. Accessory set including tools.
  2. Portable test set.
  3. Spare-fuse cabinet.
- G. Identification:
1. Mimic bus engraved laminated plastic nameplate.
  2. Painted graphics.
  3. Service equipment label.

## **PART 3 - EXECUTION**

### **3.1 FIELD QUALITY CONTROL**

- A. Testing:
1. By Contractor-engaged agency or Contractor.
- B. Tests:
1. Infrared scanning.

**- END OF SECTION -**



## - SECTION 26 2416 -

# PANELBOARDS

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## 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 QUALITY ASSURANCE

- A. Quality Standards:
  - 1. NEMA PB 1 and NFPA 70.

## PART 2 - PRODUCTS

- A. General Requirements for Panelboards:
  - 1. Constructed to withstand seismic forces.
  - 2. Enclosures: Flush and surface mounted.
    - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
    - b. Outdoor Locations: NEMA 250, Type 3R.
    - c. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
    - d. Front: Door-in-Door cover.
    - e. Directory card.
  - 3. Incoming Mains Location: Top and bottom.
  - 4. Phase, Neutral, and Ground Buses: Copper.
    - a. Optional Buses: Equipment ground or isolated ground.
  - 5. Conductor Connectors: Mechanical-type main and neutral lugs.
    - a. Optional Features: Mechanical-type feed-through lugs, sub-feed or gutter-tap lugs.
  - 6. Service equipment label for panelboards incorporating one or more main service disconnecting and overcurrent protective devices.
  - 7. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.
- B. Distribution Panelboards:
  - 1. Mains: Circuit breaker or Lugs only, as indicated.
  - 2. Branch Overcurrent Protective Devices: Plug-in circuit breakers.

3. Fused switches.
- C. Lighting and Appliance Branch-Circuit Panelboards:
  1. Mains: Circuit breaker or lugs only.
  2. Branch Overcurrent Protective Devices: Plug-in circuit-breaker type.
- D. Disconnecting and Overcurrent Protective Devices:
  1. Molded-Case Circuit Breaker: Interrupting capacity to meet available fault currents.
    - a. Circuit Breakers: Thermal-magnetic GFCI GFEP types.
    - b. Features and Accessories:
      - 1) Lugs: Mechanical style.
      - 2) Appropriate for Application: Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
      - 3) Ground-Fault Protection: Integrally mounted relay and trip unit.
      - 4) Shunt Trip: 120-V trip coil.
      - 5) Key interlock kit.
      - 6) Zone-selective interlocking.
  2. Fused Switch: NEMA KS 1, Type HD.
    - a. Auxiliary contacts.
- E. Accessories:
  1. Accessory set including tools.
  2. Portable test set.

## **PART 3 - EXECUTION**

### **3.1 FIELD QUALITY CONTROL**

- A. Testing: By Contractor-engaged agency or Contractor].
- B. Tests: Infrared scanning.

### **3.2 ADJUSTING**

- A. Load balancing.

**- END OF SECTION -**

## - SECTION 26 2713 -

**ELECTRICITY METERING & MONITORING****PART 1 – GENERAL**

- 1.1 RELATED DOCUMENTS
  - A. Drawings and general provisions of the contract, including general and Supplementary Conditions, Division 01 and Division 26 Specification Sections, apply to this Section.
- 1.2 QUALITY ASSURANCE
  - A. Electrical Components, devices and accessories: Listed and labeled as defined in NEPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction and marked for intended use.

**PART 2 – PRODUCTS**

- A. Contact Samuel Tompkins with Chevron Monitoring Services for equipment
  - 1. (913) 748-8678
- B. Components for Electrical Metering
  - 1. Veris Enercept H8036-2400-4 Networked (Modbus RTU) Energy Meter
  - 2. Current Transformers
- C. Components for Electrical Monitoring -
  - 1. Utility Vision AcquiSuite A8812 Non GSM Gateway Panel
- D. 18x16 NEMA fiberglass panel with back plate
- E. 110V two receptacle outlet
- F. Tripp-Lite Ultra 4 Isobar plug in strip
- G. Cat 5 cable and RJ45 connectors
- H. RS485 network

**PART 3 – EXECUTION**

- 3.1 FIELD QUALITY CONTROL
  - A. Testing:
    - 1. By Contractor engaged agency or contractor.

**END OF SECTION****ELECTRICITY METERING & MONITORING**



**- SECTION 26 2726 -****WIRING DEVICES**

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**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.

**PART 2 - PRODUCTS**

- A. Receptacles: Commercial Grade, 125V, 20A.
  - 1. Duplex, Commercial Grade, 125 V, 20 A.
  - 2. GFCI: Meets or exceeds UL943 (Class A GFCI), UI498. Feed through type, back and side wired, 20 A.
  - 3.
  - 4. c. UL Wet-Listed Covers While-In-Use: NEMA 3R when closed over energized plug. Vertical mount for duplex receptacle. Provide continuous use cover with cover capable of closing over energized cord cap with bottom aperture for cord exit.
- B. Cord and plug sets.
- C. Snap Switches: Commercial Grade, 120/277 V, 20 A.
  - 1. Toggle type, quiet acting, 20 amp, 120/277 volt, UL listed for motor loads up to 80 percent of rated amperage.
  - 2. Pilot light switches. Lighted handle, toggle type, red unless noted otherwise, neon pilot lamp. Pilot lamp energized when load is energized.
  - 3. Key-operated switches. 20 amp/120-277 volt, black key guide. Schlage core, per Physical Access Control & Security Management System Design Standard.
  - 4. Single-pole, double-throw, momentary contact, center-off switches.
  - 5. Key-operated, single-pole, double-throw, momentary contact, center-off switches.
- D. Wall-Box Dimmers:
  - 1. Modular, full-wave, solid-state units with slider rotary-knob control.
    - a. Incandescent: Soft tap or other quiet switch; EMI/RFI filter to eliminate interference. Illuminated when "OFF."
    - b. Fluorescent: Trim potentiometer for low-end dimming.
- E. Occupancy Sensors:



1. Wall-Switch Sensors: Adaptive-technology type with adjustable time delay.
  2. Long-Range Wall-Switch Sensors: Dual-technology type with adjustable time delay.
  3. Wide-Range Wall-Switch Sensors: Passive-infrared type with adjustable time delay.
  4. Exterior Occupancy Sensors: Passive-infrared type with adjustable time delay.
- F. Wall Plates:
1. Material for Finished Spaces: Brushed metal coverplates: stainless steel or bronze, to match other predominant architectural finishes.
  2. Material for Unfinished Spaces: Galvanized steel.
  3. Material for Damp and Wet Locations: Cast aluminum.
- G. Floor Service Fittings: Modular, dual service, with power receptacle and voice and data communication outlet.
1. Type: Flush metal.
  2. Voice and Data Communication Outlet: Blank cover with bushed cable opening.
- H. Poke-Through Assemblies: Below-floor junction box with multichanneled, through-floor raceway/firestop and detachable floor service outlet assembly.
1. Service Outlet Assembly: Flush type.
  2. Size: [3 inch (75 mm)] [4 inch (100 mm)].
- I. Multioutlet Assemblies: Metal raceways.
- J. Finishes:
1. Connected to Normal Power System: Ivory.

**- END OF SECTION -**

## **- SECTION 26 2813 -**

# **FUSES**

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### **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 QUALITY ASSURANCE**

- A. Quality Standards:
  - 1. NEMA FU 1 for cartridge fuses and UL 248-11 for plug fuses.

### **PART 2 - PRODUCTS**

- A. Cartridge Fuses: Nonrenewable.
- B. Plug Fuses: Nonrenewable.
- C. Plug-Fuse Adapters: For using Type S, rejection-base plug fuses in Edison-base fuseholders or sockets.
- D. Spare-Fuse Cabinet: Wall-mounted steel unit with fuse pullers for each size of fuse.
- E. For each class and ampere rating of fuse installed, provide the following quantities of spares for quantity of fuses installed:
  - 1. 0 to 24: Provide 6 spare.
  - 2. 25 to 48: Provide 9 spare.
  - 3. 49 and Above: Provide 12 spare.

#### **2.2 FUSE APPLICATIONS**

- A. Cartridge Fuses:
  - 1. Control Circuits: Class CC, fast acting.

- B. Plug Fuses:
  - 1. Motor Branch Circuits: Type S, dual-element time delay.

**- END OF SECTION -**

**- SECTION 26 2913 -****ENCLOSED CONTROLLERS**

---

**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.

**PART 2 - PRODUCTS**

- A. Full-Voltage Controllers:
1. Motor-Starting Switches: "Quick-make, quick-break" toggle or push-button action; nonreversing.
  2. Fractional Horsepower Manual Controllers: "Quick-make, quick-break" toggle or push-button action; nonreversing.
  3. Integral Horsepower Manual Controllers: "Quick-make, quick-break" toggle or push-button action; nonreversing.
  4. Magnetic Controller: Full voltage, electrically held.
    - a. Configuration: Nonreversing.
    - b. Control Circuit: 120-V ac, integral CPT, with primary and secondary fuses CPT with 50 VA spare capacity.
    - c. Overload Relay: Melting alloy.
  5. Combination Magnetic Controller: Fusible, and with auxiliary contacts.
- B. Enclosures: NEMA ICS 6.
1. Dry and Clean Indoor Locations: Type 1.
  2. Outdoor Locations: Type 3R.
  3. Other Wet or Damp Indoor Locations: Type 4.
- C. Accessories:
1. Push Buttons: Covered types; momentary as indicated.
  2. Pilot Lights: LED types; colors as indicated; push to test.
  3. Selector Switches: Rotary type.
  4. Elapsed time meters.
  5. Panel-type meters.
  6. Contactor auxiliary contact(s).
  7. Auxiliary and adjustable solid-state time-delay relays.

8. Solid-state, phase-failure, phase-reversal, and undervoltage and overvoltage relays.
9. Breather and drain assemblies.
10. Space heaters for outdoors or unconditioned interior spaces subject to humidity and temperature swings.
11. Sun shields installed on fronts, sides, and tops of enclosures installed outdoors and subject to direct and extended sun exposure.
12. Terminals for connecting power factor correction capacitors to the [line] [load] side of overload relays.
13. Spare control wiring terminal blocks.

## **PART 3 - EXECUTION**

### **3.1 FIELD QUALITY CONTROL**

- A. Testing: By Contractor-engaged agency Contractor.

**- END OF SECTION -**

## **- SECTION 26 3353 -**

# **STATIC UNINTERRUPTIBLE POWER SUPPLY**

---

## **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 QUALITY ASSURANCE**

- A. Quality Standard: UL 1778.

### **1.3 WARRANTY**

- A. Batteries: Materials and workmanship.

## **PART 2 - PRODUCTS**

- A. Performance Requirements:
  1. Load: 50 percent unbalanced continuously.
  2. Minimum Duration of Supply: 15 minutes.
  3. Input Voltage Tolerance: Plus 10, minus 20 percent form nominal voltage.
  4. Overall UPS Efficiency: Equal to or greater than 94 percent at 100 percent load, 92 percent at 75 percent load, and 92 percent at 50 percent load.
  5. Maximum Acoustical Noise: B, "A" weighting.
  6. Maximum Energizing Inrush Current: Six times the full-load current.
  7. Maximum AC Output-Voltage Regulation for Loads up to 50 percent Unbalanced: Plus or minus 2 percent.
  8. Output Frequency: 60 Hz, plus or minus 0.5 percent.
  9. Limitation of Harmonic Distortion of Input Currnet to the UPS; THD to 5 percent, maximum.
  10. Maximum Harmonic Content of Output-Voltage Waveform: 5 percent rms total and 3 percent rms for any single harmonic, for 100 percent rated nonlinear load current with a load crest factor of 3.0.

**STATIC UNINTERRUPTIBLE  
POWER SUPPLY**

11. Minimum Overload Capacity of UPS at Rated Voltage: 125 percent of rated full load for 10 minutes, and 150 percent for 30 seconds in all operating modes.
  12. Maximum Output-Voltage Transient Excursions from Rated Value:
    - a. 50 Percent: Plus or minus 5 percent.
    - b. 100 Percent: Plus or minus 5 percent
    - c. Loss of AC Input Power: Plus or minus 1 percent.
  13. Input Power Factor .80
- B. UPS System:
1. Solid state devices.
  2. Surge Suppression:
    - a. Category B TVSS.
    - b. Additional surge protection from low-frequency, high-energy voltage surges.
  3. Capacity upgrade capacity for future 25 percent increase.
  4. Ventilated cabinet.
  5. Output Circuit Neutral Bus, Conductor, and Terminal Ampacity: Rated phase current times a multiple of 1.73, minimum.
- C. Components:
1. Rectifier-charger.
  2. Inverter: Pulse-width modulated, with sinusoidal output and bypass phase synchronization window adjustment.
  3. Static bypass transfer switch.
  4. Battery: Valve-regulated, recombinant, lead-calcium.
  5. Controls and indications:
    - a. Quantitative indications with plain-language messages on a digital LCD or LED.
    - b. Quantitative and basic status condition indications.
    - c. Alarm indications.
    - d. Controls: Inverter on-off, UPS start, battery test, alarm silence/reset, output-voltage adjustment.
    - e. Dry-form "C" contacts.
    - f. Emergency power off switch.
  6. Maintenance Bypass/Isolation Switch: Internally mounted.
  7. Output Isolation Transformer: Unit with low forward transfer impedance up to 3 kHz.
  8. Output distribution section for panelboards.
  9. Monitoring by remote status and alarm panel.
  10. Monitoring by remote computer.
  11. Basic Battery Monitoring: Battery ground-fault detector.
  12. Battery-cycle warranty monitoring.

## **PART 3 - EXECUTION**

### **3.1 SOURCE QUALITY CONTROL:**

- A. UPS factory tested

### **3.2 FIELD QUALITY CONTROL**

- A. Testing: By Contractor-engaged agency or Contractor.

**- END OF SECTION -**





## - SECTION 26 5100 -

# INTERIOR LIGHTING

---

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

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

### 1.2 SUMMARY

- A. Interior lighting fixtures (including fixtures mounted on exterior of building), lamps, and ballasts.
- B. Emergency lighting units.
- C. Exit signs.
- D. Lighting fixture supports.

### 1.3 QUALITY ASSURANCE

- A. Quality Standard for Exit Signs: UL 924.
- B. Mockups.

## PART 2 - PRODUCTS

- A. Ballasts for Linear Fluorescent Lamps:
  - 1. Electronic Ballasts:
    - a. Type: Instant start.
    - b. Sound Rating: A.
    - c. Total harmonic distortion rating of less than [10] [20] percent.
    - d. Transient Voltage Protection: Category A or better.
    - e. Lamp Current Crest Factor: 1.7 or less.
    - f. BF: 0.85 or higher, unless otherwise indicated on Fixture Schedule.
    - g. Power Factor: 0.98 or higher, unless otherwise indicated on Fixture Schedule.
    - h. Parallel Lamp Circuits: Multiple lamp ballasts connected to maintain full light output on surviving lamps if one or more lamps fail.
  - 2. Electronic Programmed-Start Ballasts for T5 Lamps:

- a. Lamp end-of-life detection and shutdown circuit for T5 diameter lamps.
  - b. Automatic lamp starting after lamp replacement.
  - c. Sound Rating: A.
  - d. Total Harmonic Distortion Rating: Less than 20 percent.
  - e. Transient Voltage Protection: IEEE C62.41, Category A or better.
  - f. Operating Frequency: 20 kHz or higher.
  - g. Lamp Current Crest Factor: 1.7 or less.
  - h. BF: 0.95 or higher, unless otherwise indicated on Fixture Schedule.
  - i. Power Factor: 0.95 or higher, unless otherwise indicated on Fixture Schedule.
3. Electromagnetic Ballasts: Energy saving, high-power factor, Class P, automatic-reset thermal protection.
  4. Single ballasts for multiple lighting fixtures.
  5. Ballasts for Low-Temperature Environments:
    - a. Temperatures 0 Deg F (Minus 17 Deg C) and Higher: Electronic .
    - b. Temperatures Minus 20 Deg F (Minus 29 Deg C) and Higher: Electromagnetic.
  6. Ballasts for low electromagnetic-interference environments.
  7. Ballasts for Dimmer-Controlled Lighting Fixtures: Electronic type.
    - a. Dimming Range: 100 to 5 percent of rated lamp lumens.
    - b. Ballast Input Watts: Can be reduced to 20 percent of normal.
  8. Ballasts for Bi-Level Controlled Lighting Fixtures: Electronic type.
    - a. High-Level Operation: 100 percent of rated lamp lumens.
    - b. Low-Level Operation: 50 percent of rated lamp lumens.
- B. Ballasts for Compact Fluorescent Lamps: Electronic.
1. Ballasts for Dimmer-Controlled Lighting Fixtures:
    - a. Dimming Range: 100 to 5 percent of rated lamp lumens.
    - b. Ballast Input Watts: Can be reduced to 20 percent of normal.
- C. Emergency Fluorescent Power Units:
1. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast; having integral time-delay relay; and for operating 1 fluorescent lamp(s) continuously at an output of 1100 lumens each.
  2. External Type: Self-contained, modular, battery-inverter unit, suitable for powering one or more fluorescent lamps, remote mounted from lighting fixture.
- D. Ballasts for High-Intensity-Discharge Lamps:
1. Electromagnetic Type for Metal-Halide Lamps: Constant-wattage autotransformer or regulating high-power-factor, low-noise type.
  2. Electronic type for metal-halide lamps.
  3. Auxiliary instant-on quartz system.
  4. Electromagnetic type for high-pressure sodium lamps with solid-state igniter/starter and instant-restrike device.
- E. Exit Signs: Internally lighted.
1. 70,000-hour light-emitting diodes.

2. Self-Powered Exit Signs (Battery Type): Sealed, maintenance-free, nickel-cadmium battery with fully automatic, solid-state charger with sealed transfer relay, integral self-test.
- F. Emergency Lighting Units: Self-contained, with sealed, maintenance-free, lead-acid battery and fully automatic, solid-state charger, wire guard, and integral self-test].
- G. Fluorescent Lamps:
  1. Low-mercury lamps.
  2. T8 rapid-start low-mercury lamps, rated 32 W maximum.
  3. T5 rapid-start, low-mercury lamps, rated 28 W maximum.
  4. T5HO rapid-start, low-mercury lamps, rated 54 W maximum.
  5. Compact Fluorescent Lamps: T4 double tube, low mercury, rated 13 55 W.
- H. High-Intensity-Discharge Lamps:
  1. High-pressure sodium lamps.
  2. Metal-halide lamps.
  3. Pulse-start, metal-halide lamps.
  4. Ceramic, pulse-start, metal-halide lamps.
- I. Lighting fixture support components.
- J. Retrofit kits for fluorescent lighting fixtures.

**- END OF SECTION -**



## **- SECTION 26 5600 -**

# **EXTERIOR LIGHTING**

---

## **PART 1 - GENERAL**

### **1.1 RELATED DOCUMENTS**

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

### **1.2 SUMMARY**

- A. Exterior luminaires with lamps and ballasts, luminaire-mounted photoelectric relays, poles and accessories, and luminaire lowering devices.
- B. Section does not include exterior luminaires mounted on exterior of building.

### **1.3 PERFORMANCE REQUIREMENTS**

- A. Live Load: Single load of 500 lbf (2224 N).
- B. Ice Load: 3 lbf/sq. ft. (143.6 Pa).
- C. Wind Load:
  - 1. Wind speed for poles 50 feet (15 m) or less in height is 70 mph (113 km/h).

### **1.4 QUALITY ASSURANCE**

- A. Quality Standard: AASHTO LTS-4, IEEE C2

### **1.5 WARRANTY**

- A. Materials and Workmanship for Luminaires: one year.
- B. Finish, Materials, and Workmanship for Poles: one year

## **PART 2 - PRODUCTS**

- A. Luminaire Finishes:
  - 1. Field-painting finish.

2. Steel Luminaires: Factory painted, polyurethane enamel.
- B. Photoelectric Relays: Single throw, UL listed, factory mounted to luminaire, with directional lens in front of photocell.
- C. Fluorescent Ballasts and Lamps: Suitable for low-temperature environments. Low-mercury-type lamps.
- D. High-Intensity-Discharge Lamp Ballasts: Constant-wattage autotransformer or regulating high-power-factor type and suitable for low-temperature starting.
  1. Auxiliary, instant-on, quartz system.
  2. High-pressure sodium ballasts.
- E. High-Intensity-Discharge Lamps: High-pressure sodium or Metal-halide lamps.
- F. Steel Poles: Round, straight or Square, straight.
  1. Mast Arms: Single-arm type.
  2. Brackets for luminaires.
  3. Pole-top tenons.
  4. Steps.
  5. Intermediate handhole and cable support.
  6. Grounding and bonding lugs.
  7. Cable support grip.
  8. Platform for lamp and ballast servicing.
  9. Finish: Factory painted.
- G. Aluminum Poles: round, straight and square, straight.
  1. Pole-top tenons.
  2. Grounding and bonding lugs.
  3. Brackets for luminaires.
  4. Finish: Class I, color anodic.
- H. Pole Accessories:
  1. Base cover.
  2. Banner arms.
  3. Flag holders.
- I. Lowering system for luminaires.
- J. Exterior Lighting Device Type :
  1. Voltage: 120 or 277-V ac.
  2. Lamps: as scheduled.
  3. Ballast Types and Features:
  4. Photoelectric Control: Integrally or remote..
  5. Lens: polycarbonate

6. IESNA Lateral Distribution Class: I or III.
7. IESNA Cutoff Category: Cutoff.

**- END OF SECTION -**





# DIVISION 27 – TELECOMMUNICATIONS

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**- SECTION 27 0000 -****TELECOMMUNICATION BASIC REQUIREMENTS**

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**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 general administrative and procedural requirements for Sections under Division 27, and is intended to supplement, not supersede, Division 1 requirements.
- B. The requirements described herein include the following:
  - 1. References
  - 2. Definitions
  - 3. Submittals
  - 4. Quality Assurance
  - 5. Delivery, Storage And Handling
  - 6. Scheduling
  - 7. Warranty
  - 8. Project Management and Coordination Services.
  - 9. Field quality control.
  - 10. Project Closeout and Record Documents
- C. 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. Division 0 and Division 1 of the Project Manual apply to 27 00 00series Sections.
  - 3. Section 27 05 28 - Telecommunications Building Pathways
  - 4. Section 27 11 00 - Telecommunications Rooms
  - 5. Section 27 05 26 - Telecommunications Bonding
  - 6. Section 27 15 13 - Telecommunications Horizontal Cabling
  - 7. Section 27 13 10 - Telecommunications Backbone ISP Cabling
  - 8. Section 27 13 14 - Telecommunications Backbone OSP Twisted Pair Cabling
  - 9. Section 27 13 24 - Telecommunications Backbone OSP Fiber Optic Cabling
  - 10. Section 27 08 00 – Telecommunications Testing

### 1.3 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. United States Department Of Labor (DOL) Regulations (Standards - 29 CFR)
    - a. Part 1910, "Occupational Safety and Health Standards"
  2. National Fire Protection Agency (NFPA)
    - a. NFPA 70, "National Electrical Code" (NEC).
    - b. NFPA 75, "Protection Of Information Technology Equipment"
  3. California Code of Regulations (CCR) Title 24, California Building Standards Code Part 2, Basic Building Regulations and Part 3, California Electrical Code (CEC).
  4. Uniform Building Code (UBC).
  5. Uniform Fire Code (UFC).
  6. Uniform Mechanical Code (UMC).
  7. National, State, Local and any other binding building and fire codes.
  8. FCC Regulations:
    - a. Part 15 – Radio Frequency Devices & Radiation Limits
    - b. Part 68 – Connection of Terminal Equipment to the Telephone Network
- 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
    - d. UL 1690: Data-Processing Cable
    - e. UL 1963: Communications-Circuit Accessories
    - f. UL 2024A: Optical Fiber Cable Routing Assemblies.
  2. ANSI/TIA/EIA-568-B Commercial Building Telecommunications Cabling Standard.
    - a. Part 1: General Requirements
    - b. Part 2: Balanced Twisted-Pair Cabling Components
    - c. Part 2, Addendum 1: Transmission Performance Specifications For 4-Pair 100 Ohm Category 6 Cabling
    - d. Part 3: Optical Fiber Cabling Components Standard
  3. ANSI/TIA/EIA-569-A 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-3 Access Floors
  - d. TIA/EIA-569-A-4 Poke-Thru Fittings
  - e. TIA/EIA-569-A-6 Multi-Tenant Pathways and Spaces
  - f. 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-80-576-2002 Category 1 & 2 Individually Unshielded Twisted Pair Indoor Cables for Use in Communications Wiring Systems
    - b. ANSI/ICEA S-83-596-1994 Fiber Optic Premises Distribution Cable
    - c. ANSI/ICEA S-87-640-1999 Fiber Optic Outside Plant Communications Cable
    - d. 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
    - e. 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
    - c. Wireless Design Reference Manual (WDRM)
    - d. Network Design Reference Manual (NDRM)
- D. Make a copy of each document readily available during the course of construction for reference by field personnel.

#### 1.4 DEFINITIONS

- A. The Definitions of Division 0 shall apply to the 27 00 00 sections.
- B. In addition to those Definitions of Division 0, the following list of terms as used in this Section and Sections 27 00 00 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": [Rosendin Electric]

## 1.5 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.

## 1.6 SUBMITTALS

- A. Submit required submittals in accordance with Section 01 25 00.
- 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 25 00. In the absence of requirements given, submit nine product data submittals.
  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, 2000")
      - 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 25 00 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 25 00. In the absence of requirements given, submit six sets of shop drawings.
- 2. **Media:** Submit shop drawings on media as described in Section 01 25 00. 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 25 00. In the absence of requirements given, submit six sets of as-built drawings.
2. Media: Submit shop drawings on media as described in Section 01 25 00. 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 25 00. In the absence of requirements given, submit six product data submittals.
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.

## 1.7 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 additional requirements stated in Sections 27 05 26 through 27 13 24

### 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.

## 1.8 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.

**1.9 WARRANTY**

- A. Refer to Sections listed in 1.01, C for specific subsystem warranty period requirements.
- B. 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.
- C. 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.
- D. 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.
- E. Conformance to certain government standards on quality assurance may be required for some applications outlined in these specifications.

## **PART 2 - PRODUCTS**

### **2.1 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 the 27 00 00 series 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.

### **2.2 SUBSTITUTIONS**

- A. Requests for substitutions shall conform to the general requirements and procedure outlined in Division 1.
- 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 equivalent" 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**

### **3.1 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.

### **3.2 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.

### **3.3 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.

### 3.4 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.

### 3.5 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.

### 3.6 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.



**3.7 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 0526 -**

**TELECOMMUNICATION BONDING**

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**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. Section Includes: Bonding telecommunications infrastructure devices and equipment to Telecommunications Grounding Backbone.
- B. Related Sections
  - 1. Comply with the Related Sections paragraph of Section 27 00 00.
  - 2. Division 26 – Grounding, Telecommunications Grounding Backbone

**1.3 REFERENCES**

- A. Comply with the References requirements of Section 27 00 00.
- B. In addition to those codes, standards, etc., list in Section 27 00 00, comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified:
  - 1. NFPA 70, National Electric Code:
    - a. Chapter 8: Communications Systems
    - b. Article 250: Grounding
  - 2. Underwriters Laboratories, Inc. (UL) UL 467: Grounding and Bonding Equipment
  - 3. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
    - a. IEEE 467: IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems
    - b. IEEE P1100: IEEE Recommended Practice for Powering and Grounding Sensitive Electronic Equipment in Industrial and Commercial Power Systems

**1.4 DEFINITIONS**

- A. Definitions as described in Section 27 00 00 shall apply to this section.
- B. In addition, the following list of terms as used in this specification shall be defined as follows:

1. "CM": Circular Mil.
2. "MBRGB": Main Building Reference Grounding Busbar.
3. "TBB": Telecommunications Bonding Backbone.
4. "TBC": Telecommunications Bonding Conductor.
5. "TGB": Telecommunication Grounding Busbar.
6. "TMGB": Telecommunication Main Grounding Busbar.

## 1.5 SYSTEM DESCRIPTION

- A. Grounding Backbone System – Provided under another section
1. Refer to Division 26 for detailed information regarding the Telecommunications Grounding Backbone system.
  2. The Telecommunications Grounding Backbone system contains grounding bus bars, grounding conductors, bonding conductors, and connecting devices (including but not limited to pressure connectors, lugs, clamps, or exothermic welds). These components provide a low impedance path to ground for stray voltages or spurious signals present on telecommunications media and equipment.
  3. TMGB: The TMGB is located in the Entrance Facility Room. The TMGB has a connection to the following:
    - a. MBRGB.
    - b. Overhead cable tray within the room, via TBC.
    - c. Ground bushings installed on each entrance conduit within the Entrance Facility, via TBC.
    - d. Dedicated power panels within the Entrance Facility serving telecommunication equipment, via TBC.
    - e. Each TBB.
  4. TBB: TBBs originate in Entrance Facility, and route to the MDF and each IDF with a connection to each TGB.
  5. TGB: A TGB exists in the MDF and each of the IDF rooms.
- B. Base Bid Work
1. Provide labor, materials and equipment necessary to bond telecommunications infrastructure devices and equipment to Telecommunications Grounding Backbone.
  2. TBCs within each telecommunications room from the TMGB and TGBs to the following components:
    - a. Rack bay to TMGB/TGB.
    - b. Overhead cable support to TMGB/TGB.
    - c. Ground bushings installed on each conduit opening within the space if conduit is provided by Contractor to TMGB/TGB.
  3. Bonding jumpers between cable basket and cable runway joints and splices, and between overhead cable support and equipment racks.

## 1.6 SUBMITTALS

- A. General: Conform to Submittal requirements as described in Section 27 00 00.

- B. Quantity: Furnish quantities of each submittal as noted in Section 27 00 00.
- C. Product Data Submittal
  - 1. Format: As described in Section 27 00 00.
  - 2. Content: In addition to requirements of Section 27 00 00, include the following:
    - a. Product Data: "catalog cuts", data sheets, specifications, and block wiring diagrams (if necessary) of bonding devices and installation accessories. This data shall clearly describe the physical and dimensional information, performance data, electrical characteristics, materials used in fabrication, and material finish.
    - b. Clearly indicate by arrows or brackets precisely the model and accessories submitted on.
- D. Substitutions
  - 1. Requests for substitutions shall conform to the general requirements and procedure outlined in Section 27 00 00.

## 1.7 QUALITY ASSURANCE

- A. Comply with Quality Assurance requirements of Section 27 00 00.

## 1.8 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Comply with Delivery, Storage and Handling requirements of Section 27 00 00.

## 1.9 WARRANTY

- A. Match warranty of Section 27 11 00.

# PART 2 - PRODUCTS

## 2.1 BONDING CONDUCTORS

- A. TBC
  - 1. Conductor: #6 AWG (up to 25 feet) stranded copper.
  - 2. Insulation: Low-smoke, green in color. The following shall be printed on the conductor's jacket: insulation grade, conductor gauge, and applicable UL jacket listings.
  - 3. Type THHN, or approved similar.
- B. Bonding Straps for Cable Basket, Cable Runway, and/or Cable Tray
  - 1. Conductor: Flexible braided straps with factory terminated connectors.
  - 2. Manufacturer, or equal:
    - a. Chatsworth Products Inc #12061-001.
    - b. Hoffman #LGK.

## 2.2 CONNECTORS

- A. General: Connectors shall be UL listed.
- B. TBC-To-TGB/TMGB Connection
  - 1. Lug, one-hole standard barrel compression lug.
  - 2. Manufacturer: Panduit, or equal:
    - a. #LCD6-14A-L; two hole (1/4" dia. x 5/8" on center) standard barrel lug for #6 AWG conductor.
- C. TBC-To-Runway Connection
  - 1. Lug, two-hole single barrel screw termination lug.
  - 2. Manufacturer: Panduit, or equal:
    - a. #HL4-2-X; one hole (1/4") 'premium' single barrel screw lug for #6 AWG.
- D. TBC-To-Equipment Rack Connection
  - 1. Lug, one-hole standard barrel compression lug.
  - 2. Manufacturer: Panduit, or equal:
    - a. #LCA6-14-L; one hole (1/4") standard barrel compression lug for #6 AWG.
- E. TBC "C" Tap
  - 1. C-type copper thick wall compression tap, for making copper-to-copper connection.
  - 2. Manufacturer: Panduit, or equal:
    - a. #CTAPG4-6-L; C-type compression tap

## 2.3 MISCELLANEOUS

- A. Wire Clamp
  - 1. Material: nylon, UV stabilized.
  - 2. Color: black
  - 3. Size: 0.25" holding diameter for 6 AWG; or size as required based on conductor size.
  - 4. Manufacturer, or equal: Richco Inc. #N4B-BLK; clamp for 6 AWG.

# PART 3 - EXECUTION

## 3.1 GENERAL

- A. Comply with the Execution requirements of Section 27 00 00.

## 3.2 EXAMINATION

- A. Examine existing Telecommunications Grounding Backbone system prior to the start of work within this section. The Telecommunications Contractor is solely responsible to ensure work proposed within this section is fully compatible, in the opinion of the Engineer, with the existing Telecommunications Grounding Backbone system.

### 3.3 INSTALLATION

- A. Provide TBC and appropriate grounding hardware from telecommunication conduit, cable tray, cable runway, equipment racks, and other metallic telecommunication infrastructure components to the nearest TMGB/TGB as shown on Drawings.
- B. Telecommunication Bonding Conductors
  - 1. Refer to Drawings for TBC sizing. If not shown, size TBCs as the greater of 6 AWG or based on length of run using 1000CM/linear foot.
  - 2. Install TBCs in a manner that will protect them from physical and mechanical damage.
  - 3. Routing:
    - a. Route TBCs in the shortest possible path, using right-angles for turns and routed parallel to building lines.
    - b. Utilize a minimum 1-foot bend radius.
  - 4. At TMGB/TGBs:
    - a. Thoroughly clean non electrotin-plated busbar prior to fastening the conductors, bolts, or connectors to the busbar.
    - b. Attach lugs to busbar with appropriate size cadmium bronze bolt, flat washer and Belleville washer.
    - c. Torque connections.
- C. Rack Bay & Overhead Cable Support Bonding
  - 1. Refer to Drawings for detailed diagrammatic requirements for rack bay bonding.
  - 2. Rack Bay: Bond equipment racks, frames, frame bays, cabinets, server racks, and other similar support systems located within the same room or space as the TMGB/TGB to the busbar.
  - 3. Overhead Cable Support:
    - a. Bond overhead runway located within the same room or space as the TMGB/TGB to the busbar.
    - b. Provide "grounding kit" (straps & connectors) to bond sections of cable runway for ground continuity. This requirement shall apply to sections of cable runway within a single communication room.

### 3.4 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. Permanently label TBCs. Affix label as close as practical to each end of the conductor.
- B. Label Format
  - 1. Labels shall be permanent with machine-generated text; hand written labels will not be accepted.
  - 2. Labels on TBCs shall fully wrap around conductors with a self-laminating feature to provide permanent marking.

C. Identifier Assignment

1. Separate label fields of the identifier with a hyphen.
2. TBC:
  - a. First field: "TBC" (the bonding conductor type).
  - b. Second field: The room identity where TBC exists; for example: "B01-TDA".
  - c. Third field: A unique sequential number; for example: "01", "02", etc.
  - d. Example: "TBC-B01-TDA-01"

**3.5 RECORDS**

- A. Communication Bonding System records shall conform to TIA/EIA-606-A Administration Standards. Each component shall have as a minimum, the information as outlined in Table 4.7-1 of TIA/EIA-606-A.

**END OF SECTION**

**- SECTION 27 0528 -****TELECOMMUNICATION PATHWAY**

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**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. Section Includes: Telecommunications building pathways.
- B. Related Sections
  1. Comply with the Related Sections paragraph of Section 27 05 28
  2. Section 27 15 13 – Telecommunications Horizontal Cabling
  3. Section 27 13 10 – Telecommunications Backbone ISP Cabling
  4. Section 27 13 14 – Telecommunications Backbone OSP Twisted Pair Cabling
  5. Section 27 13 24 – Telecommunications Backbone OSP Fiber Optic Cabling
  6. Division 26 – Basic Materials and Methods, Conduit, Cable Tray, Boxes

**1.3 REFERENCES**

- A. Comply with the References requirements of Section 27 00 00.
- B. In addition to those codes, standards, etc., list in Section 27 00 00, comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified:
  1. ASTM A 510 Specifications for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel
  2. ASTM B 633 Specifications for Electrodepositing Coatings of Zinc on Iron and Steel, Sections SC2 and SC3.
  3. ASTM A 653 Specifications for Steel Sheet, Zinc-Coated (Galvanized) by Hot Dip Process
  4. ASTM A 591 Specifications for Electrodepositing Coatings of Zinc on steel wire or sheets.
  5. ASTM A 123 Specifications for Zinc (Hot Galvanized) Coatings on Iron and Steel.

**1.4 DEFINITIONS**

- A. Definitions as described in Section 27 00 00 shall apply to this section.



- B. "Cable Hanger": A metal, most often steel, cable support device shaped (section view) similar to the letter J; alternately, a fabric strap. The device is available in different sizes supporting different quantities of cables, and is also available with different attachment hardware to be supported by different methods (e.g., wire support, beam flange clip, etc.).
- C. "J-Hook": Another name for cable hangers.

### 1.5 SYSTEM DESCRIPTION

- A. Work Covered Under Other Sections
  - 1. Conduit, pull boxes, device boxes.
- B. Base Bid Work
  - 1. The work under this section shall include the planning and coordination with General Contractor (and other trades) of telecommunications system building pathways, the furnishing of necessary materials, and the labor & associated services required to install pathways.
  - 2. The Telecommunications Building Pathways consist of the following subsystems:
    - a. ISP innerduct, from MDF to IDFs, as shown on Drawings
    - b. Primary Pathways: Cable Basket, Cable Tray, Liner Ring Pathway, including supports
    - c. Secondary Pathways: Cable Hangers, including supports
    - d. Surface Raceway

### 1.6 SUBMITTALS

- A. General: Conform to Submittal requirements as described in Section 27 00 00.
- B. Quantity: Furnish quantities of each submittal as noted in Section 27 00 00.
- C. Submittal Requirements at Start Of Construction:
  - 1. Product Data Submittal
  - 2. Shop Drawings Submittal: Consisting of proposed changes to pathway route plans.
- D. Submittal Requirements at Close Out:
  - 1. As-Built Drawings Submittal (can be combined with shop drawings of Section 27 15 13).
- E. Substitutions
  - 1. Requests for substitutions shall conform to the requirements and procedure in Section 27 00 00.

### 1.7 QUALITY ASSURANCE

- A. Comply with Quality Assurance requirements of Section 27 00 00.
- B. NFPA Compliance: Comply with NFPA 70B, "Recommended Practice for Electrical Equipment Maintenance" pertaining to cable tray series of specifications.

**1.8 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Comply with Delivery, Storage and Handling requirements of Section 27 00 00.

**1.9 WARRANTY**

- A. Comply with Warranty requirements of Section 27 00 00.

**PART 2 - PRODUCTS****2.1 INSIDE PLANT INNERDUCT, RISER RATED**

- A. Application: Suitable for an indoor installation, typically within a riser system or backbone conduit, for the support of telecommunications fiber optic cables.
- B. Description: Designed and manufactured as a continuously extruded corrugated pipe.
- C. Material: Fabricated from Capron resin, or equivalent.
- D. Manufacturers, or equal:
  - 1. Carlon "Riser Guard" series innerduct
  - 2. Endot "Endocor/RI" series innerduct
  - 3. Pyramid "Fire Flex Riser Duct" series innerduct

**2.2 INSIDE PLANT INNERDUCT, PLENUM RATED**

- A. Application: Suitable for an indoor installation, typically within a riser system or backbone conduit, and within plenum spaces, such as above ceiling or within an access floor, for the support of telecommunications fiber optic cables.
- B. Description: Designed and manufactured as a continuously extruded corrugated pipe.
- C. Material: Fabricated from PVDF resin, or equivalent.
- D. Manufacturers, or equal:
  - 1. Carlon "Plenum Guard" series innerduct
  - 2. Endot "Endocor/PL" series innerduct
  - 3. Pyramid "Fire Flex Plenum Duct" series innerduct

**2.3 CABLE BASKET**

- A. Application: Suitable for indoor installation to support, store, and manage telecommunications cables, either overhead or mounted vertically on a wall.

- B. Description: Cable basket shall be made of high strength steel wires and formed into a mesh pattern with intersecting wires welded together. Wire ends along sides (flanges) shall be rounded during manufacturing for safety of cables and installers. Straight section longitudinal wires shall be straight with no bends.
- C. Materials and Finishes: Material and finish specifications for each wire basket type pathway are as follows:
  - 1. Yellow Zinc Dichromate: Straight sections shall be made from steel meeting the minimum mechanical properties of ASTM A510 and shall be electro-plated yellow zinc dichromate in accordance with ASTM B633 SC2.
  - 2. Paint: Straight sections shall be painted flat black over Yellow Zinc Dichromate.
  - 3. Hardware shall be either yellow zinc dichromate in accordance with ASTM B633 SC2 or AISI Type 304 Stainless Steel.
- D. Refer to Drawings for sizes.
- E. Manufacturers, or equal:
  - 1. B-Line WB series
  - 2. Cablofil EZ-Tray series
  - 3. GS Metals Flextray series
  - 4. Chalfant Wire Mesh series

## 2.4 CABLE HANGERS

- A. Application: Suitable for indoor installation within ceiling space for the support of telecommunications cables.
- B. Listings: UL 2043, for use in air handling spaces
- C. Manufacturers (or variation per installation method), or equal:
  - 1. B-Line #BCH12-W2; hanger for up to 16 cables
  - 2. B-Line #BCH21-W2; hanger for up to 50 cables
  - 3. B-Line #BCH32-W2; hanger for up to 80 cables
  - 4. Erico #CAT12; hanger for up to 16 cables
  - 5. Erico #CAT2; hanger for up to 50 cables
  - 6. Erico #CAT32; hanger for up to 80 cables
  - 7. Panduit #JMjH2-X20; hanger for up to 30 cables
  - 8. Panduit #JMjH2W-X20; hanger for up to 30 cables, wall-mount type

## 2.5 DROP WIRE

- A. Application: Suitable for indoor installation within ceiling space into structure above (e.g., slab and/or deck) for the support of telecommunications support devices.
- B. Listings: UL 2043, for use in air handling spaces.

- C. Assembly shall be equipped with ceiling clip, pre-mounted fastening pin, plastic washer, and pre-tied wire.
  - 1. Fastening pin shall be 7/8".
  - 2. Wire shall be 12 gauge.
- D. Manufacturer, or equal:
  - 1. Hilti #CC27 X-AL-H22P8T xx ft PT; drop wire assembly, xx foot wire – where "xx" is the length

## 2.6 LINEAR RING SYSTEM ("SNAKE TRAY SERIES 201")

- A. Application: Suitable for indoor installation within ceiling space for the support of telecommunications cables.
- B. Description: Designed and manufactured as sections from a single wire spine and multiple support rings. The sections shall be hand-bendable in any direction along any plane, and shall not require tools, cutting, clipping or modifications to the structure of the tray to create the bend. The system shall allow cables to enter or exit in any direction at any point along the length of the sections, while also providing for the addition or removal of cables without modification or manipulation of the system, including hanging hardware.
- C. Material: Wire, both spine and rings, shall be cold rolled steel in accordance with ASTM A510 and zinc plated in accordance with ASTM B633 SC2.
- D. Finish: Yellow Zinc Dichromate plated in accordance with ASTM A633 type II SC2.
- E. Accessories
  - 1. Accessories include, but are not limited to, threaded rod, coupling adapters, tray connectors, mounting brackets, turnout components and other necessary installation accessories.
  - 2. Accessories shall be made from high strength steel wires and/or sheet steel formed, welded and plated as required as per applicable ASTM standards.
- F. Manufacturer: Cable Management Solutions
  - 1. #CM-201-3-8; Snake Tray Series 201, 3"D x 3"W ring size
  - 2. #CM-201-425-8; Snake Tray Series 201, 4.25"D x 4.25"W ring size
  - 3. #CM-201-6-8; Snake Tray Series 201, 4"D x 6"W ring size
  - 4. #CM-201-425D-8; Snake Tray Series 201, 4.25"D x 4.25"W two sets of rings
  - 5. #CB-10; tray connector
  - 6. #WBN-201; wall mount bracket
  - 7. #CBN-201; cabinet-top mount bracket
  - 8. #TO-101; cable drop out

## **PART 3 - EXECUTION**

### **3.1 GENERAL**

- A. Comply with the Execution requirements of Section 27 00 00.

### **3.2 EXAMINATION**

- A. Examine areas to receive overhead hanger/support system prior to the start of work within this section. Notify the General Contractor of conditions that would adversely affect the installation or subsequent utilization of the system. Do not proceed with installation until unsatisfactory conditions are corrected.
- B. Installer is responsible for the integrity of the structures to which the system is attached, including their capability of safely accepting the loads imposed as evaluated by a qualified engineer

### **3.3 INSTALLATION**

- A. Innerduct
  - 1. Provide innerduct for routing of fiber optic cables. The innerduct shall be continuous from originating room to destination room. Truncate the innerduct in either room prior to slack storage.
  - 2. When routing through corridors, place innerduct in the cable tray / primary pathway / dedicated supports. When routing vertically through telecommunications rooms, support innerduct on vertical cable support (such as runway) and fasten using cable ties. When routing horizontally through telecommunications rooms, support innerduct on overhead cable support and fasten using cable ties. Install cable ties at 24-inch intervals.
  - 3. Label innerducts at both ends. The label shall be visible to a technician standing at-ease.
- B. Cable Basket
  - 1. Install cable basket pathway system in accordance with manufacturer's instructions and recognized industry practices, and ensure that the installed system complies with requirements of the NEC, and applicable portions of NFPA 70B and NECA's "Standards of Installation" pertaining to general electrical installation practices.
  - 2. Install system at locations indicated on the drawings. Routes are diagrammatic in nature. Field verify route prior to installation.
  - 3. Provide center-support hangers, trapeze hangers, or wall brackets to support/hang the cable basket pathway. If not shown in the Drawings, provide 3/8-inch diameter threaded rods for the trapeze hangers and/or center-support hangers. For wall brackets, use approved fasteners depending on the mounting substrate. Support separation shall conform to applicable codes.
  - 4. Splice straight sections using hardware specifically designed for the purpose with serrated flange locknuts.

## C. Cable Hangers

1. Install hangers in accordance with recognized industry practices, to ensure that the installed system complies with requirements of the NEC, and applicable portions of NFPA 70B and NECA's "Standards of Installation" pertaining to general electrical installation practices.
2. Provide dedicated supports at sixty inches (60") separation, maximum, per a given route. Supports shall consist of #12 wire or 1/4" threaded rod. Suspend wire or rod using components appropriate for the structure – e.g., powder-actuated clip fastener for wire, beam flange clip or angled flange clip for either wire or rod, or an embedded anchor for the threaded rod. Do not share support (wire/rod) with other trades. Do not support the hanger on ceiling grid support wires. Do not support the hanger from ductwork, piping, or other equipment hangers.
3. Install hangers six inches (6"), minimum, from light fixtures or other EMI source. Install hangers between six inches (6") and twelve inches (12") above ceiling grid.

## D. Linear Ring Pathway System

1. Install linear ring pathway system in accordance with manufacturer's instructions and recognized industry practices, and ensure that the installed system complies with requirements of the NEC, and applicable portions of NFPA 70B and NECA's "Standards of Installation" pertaining to general electrical installation practices.
2. Install system at locations indicated on the drawings. Routes are diagrammatic in nature. Field verify route prior to installation.
3. Provide dedicated supports for system at a maximum forty-eight inch (48") on center, per a given route. Supports shall consist of 3/8" (maximum size) threaded rod with appropriate hardware (nuts, washers, etc.). Do not share threaded rod with other trades.
4. Install system a minimum of six inches (6") from light fixtures, or other EMI sources. Install system between six inches (6") and twelve inches (12") above ceiling grid.
5. Provide materials necessary to properly support system from existing building construction per manufacturer's instructions, and meeting or exceeding recognized industry practices, and as appropriate for this project. Do not support from ductwork, piping, or other equipment hangers.
6. Splice system sections using UL classified connector bolt, supplied by the same manufacturer.
7. Ground system per NEC 70 Article 250. Provide approved connection bolt to join system sections such that the spine of the system is considered a bonding jumper. Properly bond system to approved ground, as per NEC Article 250. Provide external grounding strap at expansion joints, sleeves, crossovers, and at other locations where system continuity is interrupted.

**END OF SECTION**



**- SECTION 27 0800 -****TELECOMMUNICATION TESTING**

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**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 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 15 13 - Telecommunications Horizontal Cabling
  - 4. Section 27 13 10 – Telecommunications Backbone ISP Cabling
  - 5. Section 27 13 14 – Telecommunications Backbone OSP Twisted Pair Cabling
  - 6. Section 27 13 24 – Telecommunications Backbone OSP Fiber Optic Cabling
- C. Products Furnished and Installed Under Other Sections:
  - 1. Telecommunications Cabling

**1.3 REFERENCES**

- A. Comply with Section 27 00 00 References requirements.
- B. Additional references to those listed in Section 27 00 00.
  - 1. TIA/EIA-526-14 (“OFSTP-14”) Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant.
  - 2. TIA/EIA-526-7 (“OFSTP-7”) Measurement of Optical Power Loss of Installed Singlemode Fiber Cable Plant
  - 3. 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)



#### 1.4 DEFINITIONS

- A. Refer to Definitions of Sections 27 00 00, 27 15 13, 27 13 10, 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.

#### 1.5 SYSTEM DESCRIPTION

- A. Work Provided Under Other Sections
  - 1. Refer to Section 27 15 13 for a more complete System Description.
  - 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	Multimode	Characterization	Both	850nm and 1300nm
Backbone	Singlemode	Characterization	Both	1310nm and 1550nm
Backbone	Multimode	Passive Link Ins. Loss	One	850nm and 1300nm
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.

## 1.6 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.

### 1.7 QUALITY ASSURANCE

- A. Comply with the Quality Assurance requirements of Section 27 00 00.

### 1.8 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 additional cost to the Owner. This includes the retaining the services of a neutral party to observe all retesting.

## PART 2 - PRODUCTS

### 2.1 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.

### 2.2 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. LED-based light source for multimode fiber testing shall have a:
  - 1. Center wavelength of  $850\text{nm} \pm 30\text{nm}$  and  $1300\text{nm} \pm 20\text{nm}$ .
  - 2. Spectral width (FWHM)  $30\text{nm} - 60\text{nm}$  at  $850\text{nm}$  and  $100\text{nm} - 140\text{nm}$  at  $1300\text{nm}$ .
  - 3. Minimum output power level of  $\geq 14\text{dBm}$ .

- D. VCSEL-based light source for multimode fiber testing shall have a:
1. Center wavelength of  $850\text{nm} \pm 30\text{nm}$  and  $1300\text{nm} \pm 20\text{nm}$ .
  2. Spectral width (FWHM)  $30\text{nm} - 60\text{nm}$  at  $850\text{nm}$  and  $100\text{nm} - 140\text{nm}$  at  $1300\text{nm}$ .
  3. Minimum output power level of  $\geq 14\text{dBm}$ .
- E. LASER-based light source for singlemode fiber testing shall have a:
1. Center wavelength of  $1310\text{nm} \pm 20\text{nm}$  and  $1550\text{nm} \pm 20\text{nm}$ .
  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  $\geq 3\text{dBm}$ .
- F. 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).
- G. Equipment shall be factory-calibrated within 12 months of testing date.
- H. Equipment:
1. Agilent Technologies' WireScope 350 test set
    - a. #450-1070 Fiber SmartProbe testing adapter, multimode  $850\text{nm}$ .
    - b. #450-1080 Fiber SmartProbe testing adapter, multimode  $1300\text{nm}$ .
    - c. #450-2020 Fiber SmartProbe testing adapter, singlemode  $1300\text{nm}$ .
    - d. ScopeData management software (version 5.20 or higher).
  2. Corning Cable Systems
    - a. #OS-301 light source
    - b. #OS-302 light source
    - c. #OS-100D light source
  3. Fluke Networks' DSP-4300 test set
    - a. #DSP-4300; "CableAnalyzer" test kit, loaded with firmware version 3.0.4.
    - b. #DSP-FTA420S; 'Multimode' fiber testing adapter, LED-based ( $850\text{nm}$ ,  $1300\text{nm}$ ).
    - c. #DSP-FTA430S; 'Singlemode' fiber testing adapter, LASER-based ( $1310\text{nm}$ ,  $1550\text{nm}$ ).
    - d. #DSP-FTA440S; 'Gigabit' fiber testing adapter, VCSEL-based (multimode @  $850\text{nm}$  and singlemode @  $1310\text{nm}$ ).
    - e. LinkWare; "LinkWare" management software (latest version).
  4. Laser Precision #5150 test set

### 2.3 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  $\pm 0.2$ dB.
- D. Equipment shall be factory-calibrated within 12 months of testing date.
- E. Equipment:
  - 1. Agilent Technologies' WireScope 350 test set
    - a. #450-1070 Fiber SmartProbe testing adapter, multimode 850nm.
    - b. #450-1080 Fiber SmartProbe testing adapter, multimode 1300nm.
    - c. #450-2020 Fiber SmartProbe testing adapter, singlemode 1310nm.
    - d. ScopeData management software (version 5.20).
  - 2. Corning Cable Systems,
    - a. #OTS-210 power meter, with data storage capacity.
    - b. #OTS-310 power meter, with data storage capacity.
  - 3. Laser Precision #5025 test set

**2.4 FIBER OPTIC MANDREL**

- A. For jacketed (3.0 mm) fiber, mandrel diameter shall be 22 mm for 50/125 um fiber. For unjacketed buffered (0.9 mm) fiber, mandrel diameter shall be 25 mm for 50/125 um fiber.
- B. Equipment: Fluke Networks
  - 1. #NF-MANDREL-50; red mandrel for jacketed 50/125 um fiber

**2.5 FIBER OPTIC OTDR**

- A. Multimode Source Module:
 

Wavelength	Dynamic Range	Attenuation Deadzone	Reflective Deadzone	Loss Resolution	Distance Accuracy
850nm	24dB	6.5mt	3.0mt	0.001dB	0.1mt
1300nm	27dB	7.0mt	3.0mt	0.001dB	0.1mt
- B. 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
- C. Equipment, including main unit and source modules, shall be factory-calibrated within 12 months of testing date.
- D. 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

## 2.6 FIBER OPTIC TEST CORDS

- A. Multimode Fiber Optic Test Cord
  1. The fiber of the multimode test cord(s) shall have the core diameter and numerical aperture nominally equal to that of the multimode 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 850nm and 1300nm, as measured per FOTP-171 D2.
- B. 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).

## 2.7 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, 100Base-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 firmware version 3.1.1.
  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 firmware version 3.0.4.
  - 3. "LinkWare" reporting and documentation software (version 1.1, or higher)

## 2.8 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

## 3.1 SCHEDULING

- A. Prepare a schedule for testing activities based on the schedule developed in Sections 27 15 13, 27 13 10, 27 13 14, and 27 13 24. 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.

## 3.2 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.

**3.3 "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.

**3.4 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:
 

Multimode	Corning 50/125 Infinicor	1.483 @ 850nm	1.483 @ 1300nm
	SYSTIMAX 50/125	1.483 @ 850nm	1.478 @ 1300nm
Singlemode	SYSTIMAX	1.466 @ 1310nm	1.467 @ 1550nm
	Corning SMF-28	1.4675 @	1.4681 @ 1550nm
		1310nm	
    - b. Pulse Width: multimode: 20ns; singlemode: 50 ns.
 

Multimode 50/125	4 ns for cable lengths up to 500 meters
	20 ns for cable lengths from 250 meters to 2,000 meters
Singlemode	10 ns for cable lengths up to 2,000 meters
	50 ns for cable lengths from 2,000 meters to 20 kilometers
    - c. Backscatter:
      - 1) Multimode: -67dB @ 850nm, -74dB @ 1300nm;
      - 2) Singlemode: -74dB @ 1310nm and 1550nm
    - d. Event Threshold: 0.05dB for both multimode and singlemode



- e. Reflection Threshold:
    - 1) Multimode: -45dB
    - 2) Singlemode: -60dB
  - f. Fiber Break/End-Of-Fiber: 3dB for both multimode and singlemode
  - 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.

**3.5 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 multimode fibers shall be performed according to “Test Method B: One Jumper Reference”, per OFSTP-14, for ‘permanent’ links, and shall be performed according to “Test Method C: Three Jumper Reference”, per OFSTP-14, for ‘channel’ links.
  2. 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
Multimode (50/125)	0.50 dB Max	0.20 dB Max
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. Determine the Launch Category of the Light Source
- a. The launch category of a light source can be determined by measuring its Coupled Power Ratio (CPR). The CPR is a measurement of the modal power distribution launched into a multimode fiber. A light source that launches a higher percentage of its power into the higher order modes of a multimode fiber produces a more over-filled condition and is classified as a lower Category than a light source that launches more of its power into just the lower order modes producing an under-filled condition. Under-filled conditions result in lower link attenuation, while over-filled conditions produce higher attenuation. Therefore, adjusting the acceptable link attenuation to compensate for a light source's launch characteristics increases the accuracy of the test procedure.

- b. Provide two test cords, one multimode (Test Cord #1) and one singlemode (Test Cord #2). Both cords shall be directly terminated on connectors that are compatible with the light source and power meter.
- 1) The fiber of the multimode test cord shall have the core diameter and numerical aperture nominally equal to those of the permanent link.
  - 2) The fiber of the singlemode test cord shall contain Class IVa singlemode fiber, with a mode field diameter of  $5.0\mu\text{m} \pm 0.5\mu\text{m}$  for 850nm tests and  $9.0\mu\text{m} \pm 1.0\mu\text{m}$  for 1300nm tests.
- c. Connect test cord #1 between the light source and the power meter. Avoid placing bends in the cord that are less than 4 inches in diameter.
- d. The meter reading is the Reference Power Measurement ( $P_{\text{ref}}$ ). If the power meter has a Relative Power Measurement Mode, enter the Reference Power Measurement ( $P_{\text{ref}}$ ) value into the meter. If it does not, hand-write  $P_{\text{ref}}$  for future reference.
- e. Disconnect test cord #1 from the power meter. Do not disconnect test cord #1 from the light source.
- f. Connect test cord #2 between the power meter and test cord #1, using an appropriate adapter between the test cords.
- 1) Test cord #2, the singlemode cord, shall include a high order mode filter. This can be accomplished by twice wrapping the cord around a 1.2" diameter (30-mm) mandrel.
- g. The meter reading is the Power Measurement ( $P_{\text{sum}}$ ). If the power meter is in Relative Power Measurement Mode, the meter reading represents the CPR. If the meter does not have a Relative Power Measurement Mode, perform the following calculation to determine the CPR:
- 1) If  $P_{\text{sum}}$  and  $P_{\text{ref}}$  are in the same logarithmic units (dBm, dBu, etc):  $\text{CPR (dB)} = |P_{\text{sum}} - P_{\text{ref}}|$
  - 2) If  $P_{\text{sum}}$  and  $P_{\text{ref}}$  are in watts:  $\text{CPR (dB)} = |10 \times \log_{10} [P_{\text{sum}}/P_{\text{ref}}]|$

Coupled Power Ratio (CPR) in dB, for 50/125 $\mu\text{m}$  Fiber:

	<b>Cat-1 Overfilled</b>	<b>Cat-2</b>	<b>Cat-3</b>	<b>Cat-4</b>	<b>Cat-5 Underfilled</b>
850nm source	20 – 24	16 – 19.9	11 – 15.9	7 – 10.9	0 – 5.9
1300nm source	16 – 21	12 – 15.9	8 – 11.9	4 – 7.9	0 – 3.9

4. Multimode Insertion Loss Measurement
- a. After setting up the test equipment, verifying the performance of the test cords, and determining the light source's CPR, 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 ( $P_{\text{ref}}$ ). If the power meter has a Relative Power Measurement Mode, enter the Reference Power Measurement ( $P_{\text{ref}}$ ) value into the meter. If it does not, hand-write  $P_{\text{ref}}$  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.
5. 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.
6. 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. 50/125 $\mu$ m Multimode Insertion Loss Coefficients
    - 1) Cable Loss = Cable Length (km) x (3.0 dB/km @ 850-nm or 1.0B/km @ 1300-nm).
    - 2) Connection Loss (ST or SC Connectors) = (Connections x 0.4 dB) + 0.42 dB.

- 3) Connection Loss (Other mini-connectors) = (Connections x 0.2 dB) + 0.24 dB
- 4) Splice Loss = Splices x (0.05 dB for fusion or 0.10 dB for mechanical).
- 5) CPR Adjustment = See following table:

	Cat-1	Cat-2	Cat-3	Cat-4	Cat-5
Links with ST or SC Connectors	+0.50	0.00	-0.25	-0.50	-0.75
Links with mini-connectors	+0.25	0.00	-0.10	-0.20	-0.30

- d. 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.

**3.6 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.

### 3.7 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 11 00 -****TELECOMMUNICATION ROOMS**

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**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. Section Includes: Build out of telecommunications rooms and spaces.
- B. Products Specified, Furnished, and Installed Under Another Section:
  - 1. Electrical service (120V and 208V circuits and devices)
  - 2. Conduit, device boxes, and sleeves
- C. Products Furnished and Installed by the Owner:
  - 1. Network switches, UPS systems, power strips, and telephone handsets
- D. Related Divisions
  - 1. Comply with the Related Sections paragraph of Section 27 00 00.
  - 2. 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.
  - 3. General and Supplementary Conditions.
  - 4. Drawings, general provisions of the Agreement, and Division 1 apply to this Section.

**1.3 REFERENCES**

- A. Comply with the References requirements of Section 27 00 00.
- B. In addition to those codes, standards, etc., list in 27 00 00, comply with the latest edition of the following applicable specifications and standards except as otherwise shown or specified:
  - 1. ANSI/EIA-310-D-1992 Racks, Panels And Associated Equipment

**1.4 DEFINITIONS**

- A. Refer to the Definitions requirements of Section 27 00 00.

## 1.5 SYSTEM DESCRIPTION

- A. Telecommunications Rooms house the following functions:
  - 1. Data backbone crossconnect field (fiber terminations)
  - 2. Voice backbone crossconnect field (UTP terminations)
  - 3. Data system equipment (distributed switch)
  - 4. Horizontal termination field – both voice and data – of cabling served from this room (refer to floor plans for area served)
  - 5. Interconnection between the data system equipment and the horizontal termination field
  
- B. Base Bid Work
  - 1. Telecommunications Room build out includes the following work:
    - a. Preconstruction Submittals
    - b. Plywood backboards
    - c. Rack bays (equipment racks, vertical management sections, anchoring, and bracing).
    - d. Cable, wire and patch cord management.
    - e. Overhead cable support.
    - f. Seismic bracing.
    - g. Identification tags and labeling.
    - h. Record Documents.
    - i. Warranty.

## 1.6 SUBMITTALS

- A. Refer to Submittals of Section 27 00 00 for procedural, quantity, and format requirements.
  
- B. Pre-Construction Submittal Requirement: Submit the following prior to the start of construction.
  - 1. Product Data Submittal: Submit product data on products listed in this section and products not listed in this section to be installed related to this section.
  - 2. Sample Submittal: Submit sample of equipment rack label.
  - 3. Schedule Submittal: Submit proposed schedule of work (this schedule may be combined with the schedule developed for the 27 00 00 series Sections).
  
- C. Submittal Requirements at Closeout:
  - 1. As-Built Drawings.
  - 2. O & M Manuals.

## 1.7 QUALITY ASSURANCE

- A. Refer to Quality Assurance requirements of Section 27 00 00.

## 1.8 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Refer to Product Delivery, Storage and Handling requirements of section 27 00 00.

### TELECOMMUNICATION ROOMS

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**1.9 WARRANTY**

- A. Refer to Warranty requirements of section 27 00 00.

**PART 2 - PRODUCTS****2.1 EQUIPMENT RACK, FLOOR-STANDING**

- A. Application: Suitable for the support of cable termination devices, management devices, common communications equipment, and other similar equipment, installed onto floor.
- B. Material: High strength, lightweight 6061-T6 aluminum, extrusion construction.
- C. Channel:
1. Size: The mounting channels shall be 3" deep by 1.265" wide with a 0.17" thick web.
  2. Flange: The mounting channels shall have front and back mounting flanges ("double sided"). The flanges shall be 0.25" thick, and shall have mounting holes front and back.
  3. Mounting Holes: The hole pattern shall be industry standard spaced at 5/8" - 5/8" - 1/2", compatible with ANSI/EIA-310-D (1992) standard. The mounting holes shall be pre-threaded as #12-24 rolled threading.
- D. Assembled Rack: The rack shall come complete with base angles (3.5" high by 6" deep by .375" thick) and top angles (1.5" high by 1.5" deep by .375" thick). The assembled rack shall be 8'-0" high (overall) by 19" mounting width (20.25" wide overall), and shall contain 51 EIA mounting spaces.
- E. Include required accessories, such as floor installation kit, etc. for a complete installation.
- F. Manufacturer, or equal: CPI
1. #46353-715, 8'-0"H x 19" equipment rack, black.

**2.2 EQUIPMENT RACK, WALL-MOUNTED**

- A. Application: Suitable for the support of cable termination devices, management devices, common communications equipment, and other similar equipment, installed onto wall.
- B. Mounting Holes: The hole pattern shall be industry standard spaced at 5/8" - 5/8" - 1/2", compatible with ANSI/EIA-310-D (1992) standard. The mounting holes shall be pre-threaded as #12-24 rolled threading.
- C. Assembled Rack: The rack shall come complete with wall bracket and equipment mounting rails. The assembled rack shall be 25" deep by 19" mounting width, and shall contain either 27 or 41 EIA mounting spaces (RMU).
- D. Manufacturer: CPI
1. #11807-725; 49"H x 19" x 25" deep / 27 RMU wall-mounted equipment rack, black.
  2. #11792-725; 73.5"H x 19" x 25" deep / 41 RMU wall-mounted equipment rack, black.

### 2.3 VERTICAL MANAGEMENT SECTION, FOR FLOOR-STANDING RACK

- A. Application: Suitable for cable routing (back) & cord slack storage (front) vertically from the bottom of the rack to the top. The vertical management sections shall be double sided (i.e., the management section shall have covered cable guides on the front and flip-retainers on the rear).
- B. Size & Capacity: 8'-0" high by 6" wide, with 5-1/3" deep cable storage capacity in back and 6" cord storage capacity in front.
- C. Mounting: The vertical management section shall have matching bolt holes for attachment to the rack.
- D. Color: black (guides and cover).
- E. Manufacturer, or equal: CPI
  1. #30162-715, vertical mngt section, 8'-0"H x 6"W, double sided.

### 2.4 HORIZONTAL MANAGEMENT PANEL

- A. Application: Suitable for installation into equipment rack for cord routing (front). The horizontal management panel shall match (and fully integrate with) the vertical management sections.
- B. Size & Capacity: 1U high, with hinged/removable cover and pass through capacity. Management panel shall be double sided.
- C. Color: black.
- D. Manufacturer, or equal: CPI
  1. #30529-719; horizontal cable manager, 1U, double sided.

### 2.5 CABLE BASKET

- A. Refer to Section 27 11 00 for specifications of cable basket.

### 2.6 CABLE RUNWAY

- A. Cable Runway Straight Sections
  1. Application: Suitable for the support & management of communications cables, either overhead or mounted vertically on a wall. Also overhead equipment racks bracing.
  2. Material (both stringer and rung): Steel tube, rectangular, 1-1/2" by 3/8" by 0.65" wall thickness.
  3. Rungs: 12" on center, welded to stringer.
  4. Size: length: 9' 11-1/2" (cut-to-fit); width: refer to Drawings.
  5. Manufacturer, or equal: CPI
    - a. #10250-709, 9" wide universal cable runway, black.
    - b. #10250-712, 12" wide universal cable runway, black.
    - c. #10250-718, 18" wide universal cable runway, black.
    - d. #10250-724, 24" wide universal cable runway, black.

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**B. Cable Runway Sweep Fittings**

1. Material (both stringer and rung): Steel tube, rectangular, 1-1/2" by 3/8" by 0.65" wall thickness.
2. Manufacturer, or equal: CPI
  - a. #10822-712, horizontal sweep fitting for 12" wide cable runway, black.
  - b. #10822-718, horizontal sweep fitting for 18" wide cable runway, black.
  - c. #10723-712, vertical outside sweep fitting for 12" wide cable runway, black.
  - d. #10723-718, vertical outside sweep fitting for 18" wide cable runway, black.
  - e. #10724-712, vertical inside sweep fitting for 12" wide cable runway, black.
  - f. #10724-718, vertical inside sweep fitting for 18" wide cable runway, black.

**C. Cable Runway Installation Accessories**

1. Refer to Drawings for additional information and instances for installation.
2. Manufacturer, or equal: CPI
  - a. #11301-001, butt splice kit.
  - b. #11313-001, 45-degree butt splice kit.
  - c. #11314-001, 90-degree butt splice kit.
  - d. #11302-001, junction splice ("T") kit.
  - e. #10608-001, vertical wall bracket kit.
  - f. #10642-001, end caps.
  - g. #11421-712, wall angle support kit for 12" wide cable runway, black.
  - h. #11421-718, wall angle support kit for 18" wide cable runway, black.
  - i. #11421-724, wall angle support kit for 24" wide cable runway, black.
  - j. #11312-712, triangle support kit for 9" and 12" wide cable runway, black.
  - k. #11312-718, triangle support kit for 12" and 18" wide cable runway, black.
  - l. #11770-712, end closing kit for 12" wide cable runway, black.
  - m. #11770-718, end closing kit for 18" wide cable runway, black.
  - n. #11770-724, end closing kit for 24" wide cable runway, black.
  - o. #10595-712, rack-to-runway attachment kit, for 9" or 12" wide runway, black.
  - p. #10595-718, rack-to-runway attachment kit, for 18" wide runway, black.

**2.7 LABEL PLATES, FOR EQUIPMENT RACKS**

- A. Application: Label plate shall be suitable to affix onto top angle of equipment rack.
- B. Label plate shall be 'engrave-able' stock melamine plastic laminate substrate.
  1. Size (minimum): 1/2 inch high by 6 inches long by 1/16-inch thick.
  2. Color: Black.
- C. Lettering shall be engraved, shall be 1/8" high, and shall be white.

## **PART 3 - EXECUTION**

### **3.1 GENERAL**

- A. Comply with the General Execution requirements of Section 27 00 00.

### **3.2 INSTALLATION**

#### A. Rack Bays

1. Equipment Racks, Floor-Standing
  - a. Provide parts and accessories required to complete each rack.
  - b. Anchor racks to the floor using methods (concrete anchors) approved by both structural engineer and DSA. Brace racks overhead to cable runway where shown on the Drawings.
2. Equipment Racks, Wall-Mounted
  - a. Provide parts and accessories required to complete each rack.
  - b. Anchor racks to the wall using fasteners approved by DSA.
3. Vertical Management Sections
  - a. Provide vertical management sections as shown on Drawings. If not shown, default shall be one vertical management section between each rack and at either end of the bay.
  - b. Bolt vertical management sections to the equipment racks at the points designed by the manufacturer and per the manufacturer's installation instructions.
  - c. Install support devices (e.g., brackets, threaded rod with strut, etc.) per the manufacturer's instructions and fastened to the wall or ceiling using appropriate fasteners.
4. Tolerances:
  - a. Equipment Rack, Floor-Standing: Field verify dimensions to establish proper clearances as follows:
    - 1) Front: 40" clearance from channel's front mounting flange.
    - 2) Back: 57" clearance from channel's back mounting flange.
  - b. Equipment Rack, Wall-Mounted: Field verify dimensions to establish proper clearances as follows:
    - 1) Front: 40" clearance from channel's front mounting flange.
    - 2) Side: 10" between racks and between rack and wall.
    - 3) Bottom: 24" clearance from floor to bottom of rack.
  - c. Provide the correct amount of space between each rack for proper installation (according to manufacturer's written instructions) of the vertical management sections.
5. Accessories
  - a. Furnish one bag of 50 mounting screws per equipment rack.

#### B. Overhead Cable Support

1. Provide overhead cable support as shown on the Drawings for use to support cables and store cable slack within telecommunications rooms between the exit sleeves/distribution conduits and the rack bay.

2. Provide parts required to complete the installation (e.g., trapeze, junction nuts, etc.).
- C. Vertical Cable Support
1. Provide vertical cable support at the locations as shown on the Drawings for use to support cables routing vertically from conduits/sleeves to the overhead cable support.
  2. Provide parts required to complete the installation (e.g., vertical mounting brackets, bolts, etc.).
  3. If cable runway is used, install the runway such that the rungs are facing outward (the greater distance from the rung to the stringer edge is facing inward). If cable basket is used, install the basket with spacers such that the mesh is spaced 1/2" from the wall.

### 3.3 LABELING

- A. General Requirements: Labeling and identifier assignment shall conform to TIA/EIA-606-A Administration Standard and as approved by Owner before installation.
- B. Equipment Rack Label Requirements: Provide one label plate per rack. Permanently affix label plate and position the label plate centered on the rack's front top angle.
- C. Identifier Assignment
1. Equipment Racks
    - a. Prefix: "RACK"
    - b. First field: the telecommunications room identity; for example: "TDB".
    - c. Second field: the rack number; for example: "01".
    - d. Example; "RACK TDB-01"

**END OF SECTION**





## **- SECTION 27 13 10 -**

# **TELECOMMUNICATION BACKBONE ISP CABLING**

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## **PART 1 - GENERAL**

### **1.1 RELATED DOCUMENTS**

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

### **1.2 SUMMARY**

- A. Section Includes: Backbone ISP (indoor) twisted pair cabling and fiber optic cabling.
- B. Related Sections
  1. Comply with the Related Sections paragraph of Section 27 00 00 Telecommunications Basic Requirements.
  2. 27 05 28 Telecommunications Building Pathways.
  3. 27 08 00 Telecommunications Testing.

### **1.3 REFERENCES**

- A. Comply with Section 27 00 00 References requirements.

### **1.4 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. "CMP": Communications Media Plenum [NEC plenum rating]
  2. "CMR": Communications Media Riser [NEC riser/non-plenum rating]
  3. "ISP": Inside Plant [cabling]
  4. "MM": Multimode [fiber type]
  5. "PIC": Plastic Insulated Conductor
  6. "OFNP": Optical Fiber Non-conductive Plenum, plenum rating
  7. "OFNR": Optical Fiber Non-conductive Riser, non-plenum riser rating
  8. "OFN": Optical Fiber Non-conductive, general purpose indoor rating
  9. "PE": Polyethylene

10. "PVC": Polyvinyl Chloride
11. "SM": Singlemode [fiber type]

## 1.5 SYSTEM DESCRIPTION

- A. Refer to Section 27 00 00 for description of the project and building.
- B. Work Provided Under Other Sections
  1. Telecommunications Pathways (Cable Basket, Conduits, Riser Sleeves, etc.). Refer to the Drawings for size/capacity and route information.
  2. Buildout of the telecommunications rooms (e.g., backboards, overhead and vertical cable runway, etc.). Refer to the Drawings for buildout information.
- C. Base Bid Work
  1. Provide engineering, labor, materials, apparatus, tools, equipment, and transportation required to make a complete working telecommunications backbone twisted pair and fiber optic cabling system installation described in these specifications.
  2. Consider backbone cabling shown on the Drawings as base bid work, unless otherwise noted. This includes terminations at both ends, unless otherwise noted.
  3. In general, the base bid work includes:
    - a. Preconstruction Submittals.
    - b. Backbone ISP (riser) twisted pair (copper) cables and terminations.
    - c. Backbone ISP fiber optic cables and terminations.
    - d. Cable management.
    - e. Crossconnects.
    - f. Cable identification tags and system labeling.
    - g. Record Documents.
    - h. Warranty.

## 1.6 SUBMITTALS

- A. Comply with Submittal procedural, quantity, and format requirements of Section 27 00 00.
- B. Preconstruction Submittal Requirements:
  1. Product Data Submittal, indicating conformance with NEC, UL, TIA/EIA listings, certifications, and specifications.
  2. Labeling Submittal, consisting of proposed labeling scheme for backbone cables and backbone terminations.
  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. As-Built Drawings.
  2. Crossconnection records/cut sheets.
  3. O & M Manuals.

**1.7 QUALITY ASSURANCE**

- A. Comply with 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 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.

**1.8 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Comply with Delivery, Storage and Handling requirements of Section 27 00 00.

**1.9 WARRANTY**

- A. 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 electrical performance of the twisted pair cabling system to the specific category per ANSI/TIA/EIA-568-B performance criteria for backbone cabling.

**PART 2 - PRODUCTS****2.1 SHIELDED TWISTED PAIR CABLES – NON-PLENUM**

- A. Application:
  - 1. Cable shall be suitable for indoor installation, between floors in vertical riser system, under access flooring, and through overhead ceiling space (in cable tray, conduit, & hangers).
  - 2. Each and every cable run shall be a continuous single cable, homogenous in nature. Splices are not permitted anywhere.
  - 3. Cable shall be twisted pair PIC type cable, air core, with an "ALVYN" sheath. Cable shall be compatible with Bell System type "ARMM".
- 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 polyolefin, covered with an outer layer (skin) of solid PVC.
  - 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 (supper 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-hyrosopic polypropylene film, or equivalent.
  - 2. Sheath Type: "ALVYN". Sheath shall consist of an inner shield and an outer jacket.
    - a. Shield: Aluminum, 0.008", corrugated tape applied longitudinally, with an overlap.
    - b. Jacket: Flame-retardant PVC, adhesively bonded to shield.
  - 3. Cable shall be NEC rated as CMR, and UL listed as such.
- D. Performance:
  - 1. Electrical performance of the twisted pairs and overall cable shall comply with TIA/EIA-568-B Part 2 requirements for Category 3 UTP cabling.
- E. Manufacturers:
  - 1. General Cable Air Core Cables "Foam Skin ALVYN Riser Cable" series cables.
  - 2. SYSTIMAX ARMM series cables.

## 2.2 FIBER OPTIC CABLES – NON-PLENUM

- A. Application:
  - 1. Cable shall be suitable for indoor installation, between floors in vertical riser system, under access flooring, and through overhead ceiling space (in cable tray, conduit, & hangers).
  - 2. Cable shall exhibit stable performance in a building 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. 50/125  $\mu\text{m}$  Multimode fiber strands shall meet or exceed the following geometry criteria:
  - 1. Core diameter = 50  $\mu\text{m}$ ,  $\pm 3.0 \mu\text{m}$ .
  - 2. Cladding diameter = 125  $\mu\text{m}$ ,  $\pm 1.0 \mu\text{m}$ .
  - 3. Core/Cladding Concentricity =  $\leq 3 \mu\text{m}$ .
  - 4. Minimum Tensile Strength = 100,000 psi.
- C. 50/125  $\mu\text{m}$  Multimode fiber strands shall meet or exceed the following performance criteria:
  - 1. Attenuation = 3.5 dB/km at 850 nm and 1.5 dB/km at 1300 nm wavelengths, maximum.
  - 2. Overfilled Bandwidth = 500 MHz•km at 850 nm and 500 MHz•km at 1300 nm wavelengths, minimum.
  - 3. Laser Bandwidth = 2,000 MHz•km at 850 nm and 500 MHz•km at 1300 nm wavelengths, minimum.
- D. 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.
- E. 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.
- F. Buffering:
1. Each fiber shall be completely covered with a "primary coating" (acrylate material). This shall constitute the "fiber strand".
  2. Each fiber strand shall be fully covered with a flame retardant thermoplastic material (material = PVC, or equivalent thermoplastic). This shall constitute the "buffered strand" (tight buffer type), and shall have a diameter of 0.9 mm.
  3. Buffered Strands: Buffered strands shall be individually color coded to meet the requirements of ANSI/TIA/EIA-598-A-1995. (Also, ref. ANSI/ICEA S-87-640-1992).
- G. Cable Sheath:
1. Strength Element: The cable shall have an internal strength element such as aramid yarn (e.g., Kevlar).
  2. Tensile Strength: The cable shall have a 150-lb, minimum, rated load.
  3. Outer Jacket: The cable shall have a seamless outer jacket (material = PVC, or equivalent) applied to and completely covering the internal components (fiber strands, strength element, other).
  4. Flame Rating: The cable shall be NEC (Article 770) rated as OFNR, and UL listed as such.
- H. Manufacturer: Corning "MIC" series cables, or equal.

## 2.3 TERMINATION EQUIPMENT

- A. Twisted Pair Cabling Patch Panel
1. Refer to Section 27 15 13 for product requirements.
- B. 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. "Fully assembled" shall include all required installation & mounting components, and include accessories such as connector panels, coupling adapters, etc. for a complete installation.

5. 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. Provide patch cord management.
6. Manufacturer: Uniprise (by CommScope)
  - a. #RFE-FXG-EMT/1U; 1U fiber shelf, accepts 4 adapter plates
  - b. #MFA-SC06-AQ; adapter plate – 6 simplex SC multimode adapters, aqua
  - c. #SFA-SC06-BL; adapter plate – 6 simplex SC singlemode adapters, blue

## 2.4 FIBER OPTIC CONNECTORS

### A. Multimode 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 aqua.
4. Connectors shall be installable via either epoxy or anaerobic method.
5. Manufacturer: Corning Cable Systems, or equal.
  - a. #95-050-48-BP; SC connector, multimode 50/125.

### B. 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.

## 2.5 LABELS

### A. Labels for Backbone ISP Cables

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

## **PART 3 - EXECUTION**

### **3.1 GENERAL**

- A. Comply General Execution requirements of Section 27 00 00.

### **3.2 EXAMINATION**

- A. Pathways: Prior to installation, verify pathways (cable trays, conduits, etc.) exist and are 'ready' to accept backbone cables.
- B. Telecommunications Rooms: Prior to installation, verify equipment rooms are 'ready' to accept the backbone cables and terminations.

### **3.3 PREPARATION**

- A. The Contractor is solely responsible to verify that twisted pair cables and fiber optic cables are fully operational – both cable sheath and conductors (twisted pair and optical) – prior to installation.
- B. Documentation of pre-installation testing is not a close out requirement, and shall be the responsibility of the Contractor.

### **3.4 INSTALLATION – TWISTED PAIR CABLING**

- A. Backbone Cables
  - 1. General
    - a. Cable runs shall have continuous sheath continuity, homogenous in nature. Splices are not permitted anywhere.
  - 2. Placement
    - 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 a pull rope along with cables where run in conduit and spare capacity still exists in the conduit. Tie off ends of the pull rope.
  - 3. Routing
    - a. Maximum cable length from the termination within the Entrance Facility to the termination in Telecommunications Room shall be 500 meters.
    - b. Install cables within designated pathways.
    - c. When routing horizontally within telecommunications rooms, utilize the overhead cable support. When routing vertically within telecommunications rooms, utilize the wall mounted vertical cable runway and support every 24 inches on center using cable ties.
    - d. Place and suspend cables in a manner to protect them from physical interference or damage.



- e. Route cables a minimum of 6" away from power sources to reduce interference from EMI.
  - f. Provide a 10 feet (minimum) sheathed cable slack loop at each end of the run. Place the slack in the overhead cable support.
4. Termination
- a. Properly strain relieve cables at termination points per manufacturer's instructions.
  - b. Perform terminations in accordance with manufacturer's instructions and TIA/EIA-568-B standard installation practices.
  - c. Perform post-installation testing as described in the Telecommunication Testing specification.
- B. Termination Apparatus
- 1. Provide accessories required for a complete installation.
  - 2. Terminate twisted pair backbone cables to modular patch panels, terminating one pair to positions 4 and 5.
  - 3. Install the patch panels as shown on the drawing. If not is shown, install patch panels at the top of the rack.

### 3.5 INSTALLATION – FIBER OPTIC CABLING

A. Backbone Cable

**General**

- a. Cable runs shall have continuous sheath continuity, homogenous in nature. Splices are not permitted anywhere.
  - 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.
  - c. Place cables within innerduct the entire route.
2. Placement
- a. 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.
  - b. Pulling: Maintain pulling tension within manufacturer's limits.
  - c. Protection: 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. Do not use cable-pulling compounds for indoor installations.
  - f. Provide 30 feet (minimum) sheathed cable slack loop at each end of the run within the Telecommunications Rooms; place the slack in the overhead cable support.
  - g. Place a pull rope along with cables where run in conduit and spare capacity still exists in the conduit. Tie off ends of the pull rope.
3. Routing
- a. Maximum cable length from the termination within the Entrance Facility to the termination in Telecommunications Room shall be 500 meters.
  - b. Route cables in innerduct between points of termination throughout entire length (except at the fiber take up reel).

- c. Install cables within designated pathways.
  - d. Neatly dress and organize cables using designated cable routing facilities, and fasten to support devices via tie wraps or Velcro-type straps.
  - e. When routing horizontally within telecom rooms, utilize the overhead cable support. When routing vertically within telecommunications rooms, utilize the wall mounted vertical cable runway 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.
  - f. Place and suspend cables in a manner to protect them from physical interference or damage.
  - g. Provide a 10 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. Properly strain relieve cables at termination points (at/within the fiber optic termination panels) per manufacturer's instructions.
  - b. 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.
  - c. Provide required accessories and consumables for the complete termination of fiber strands.
  - d. Provide 3 feet of tight buffered fiber (unsheathed) slack at each end of the run within the patch panel/termination enclosure. Properly store fiber slack in rear of patch panel into the 'routing rings', per manufacturer's instructions.
- B. Fiber Optic Cable Termination Panel
- 1. Provide the termination panel in designated equipment rack; locate per drawings (if not shown, locate at the top).
  - 2. Provide accessories required for proper installation of each termination panel, including connector panels and adapters.

### 3.6 LABELING

- A. General Requirements
- 1. Labeling and identifier assignment shall conform to the TIA/EIA-606 Administration Standard and as approved by Owner's Representative before installation. Label colors shall conform to the TIA/EIA-606 Administration Standard.
  - 2. Provide permanent and machine-generated labels; hand written labels will not be accepted.
- B. Label Formats
- 1. Cable Labels
    - a. Text Attributes: Black, 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. Use labels included in the product packaging. Request approval by the Engineer for substitutions.

- b. Provide white label respective field type, per TIA/EIA-606.
- c. Text Attributes: Black, 3/32" high, minimum, or #10 font size.

C. Identifier Assignment

- 1. General: Separate label fields of the identifier with a hyphen.
- 2. Backbone ISP Twisted Pair Cables
  - a. First field shall identify the originating termination room identifier as shown on the plans; for example, "B01-TDA".
  - b. Second field shall identify the ending termination room identifier as shown on the plans; for example, "B01-TDB".
  - c. Third field of the identifier shall be the campus pair count range; for example, "0401-0600"
  - d. Example: "B01-TDA-B01-TDB-0401-0600"
- 3. Termination Positions at the Patch Panels
  - a. Each port shall be labeled with the pair count of the campus infrastructure.
- 4. Backbone ISP Fiber Optic Cables
  - a. First field shall identify the originating termination room identifier as shown on the plans; for example, "B01-TDA".
  - b. Second field shall identify the ending termination room identifier as shown on the plans; for example, "B01-TDB".
  - c. Third field shall identify the type and number of strands; for example, "Mxxx" where "M" stands for multimode or "S" for singlemode and xxx stands for the ending fiber strand sequential count.
  - d. Example: "B01-TDA- B01-TDB-M025-M036"
- 5. Termination Positions at the Termination Panels
  - a. First field of the identifier shall be the destination room; for example "TO B01-TDB".
  - b. Second field of the identifier shall be the strand count range; for example, "M025-M036"
  - c. Identifier Example: "TO B01-TDB M025-M048".

**3.7 FINAL INSPECTION**

- A. Inspect installed products and work in conjunction with the District or District'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 13 14 - TELECOMMUNICATION BACKBONE OSP TWISTED PAIR CABLING

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## **PART 1 - GENERAL**

### **1.1 RELATED DOCUMENTS**

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

### **1.2 SUMMARY**

- A. Section includes: Backbone outside plant (OSP) twisted pair cabling.
- B. Related Sections
  - 1. Comply with the Related Sections paragraph of Section 27 00 00.
  - 2. Section \_\_\_ - <Telecommunications> Underground Pathways
  - 3. Section 27 05 28 - Telecommunications Building Pathways
  - 4. Section 27 08 00 - Telecommunications Testing
- C. Products Furnished and Installed Under Another Section:
  - 1. Conduits, pullboxes, and other underground pathways.

### **1.3 REFERENCES**

- A. Comply with the References requirements of Section 27 00 00.

### **1.4 DEFINITIONS**

- A. Refer to Division 1 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

## 1.5 SYSTEM DESCRIPTION

### A. Base Bid Work

1. Base bid 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 base bid 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

## 1.6 SUBMITTALS

- A. Comply with Division 1 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.
- C. Closeout Submittal Requirements:
  1. As-Built Drawings.
  2. O & M Manuals.

## 1.7 QUALITY ASSURANCE

- A. Comply with Division 1 Quality Assurance requirements.
- B. Contractor Qualifications
  1. In addition to the Contractor Qualifications requirements of Division 1, 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.

**1.8 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Comply with Division 1 Delivery, Storage and Handling requirements.

**1.9 WARRANTY**

- A. The OSP cabling shall be warranted under the minimum Project warranty. Refer to Division 1 for requirements.

**PART 2 - PRODUCTS****2.1 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 (supper 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. Manufacturers:
1. General "Filled Foam Skin ASP (Spec 2100)" series cables.
  2. Belden Communications "Exchange Cable, Filled ASP Cable For Buried Installations" series.
  3. Superior Essex "Filled ASP ANMW" series cables.

## 2.2 AERIAL CABLES

- A. Application:
1. Cable shall be suitable for outdoor aerial installations.
  2. Cable shall be twisted pair PIC type cable, air core, with an "ALPETH" sheath. Cable shall be compatible with Bell System type "BKMA" and RUS type "PE22".
- B. Conductors:
1. Conductors shall be 24 AWG annealed solid copper.
  2. Conductors shall be fully insulated. Insulation shall consist 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 (supper 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. Sheath Type: "ALPETH". Sheath shall consist of a shield and an outer jacket.
    - a. Shield: Corrugated tape of aluminum longitudinally applied, with a locking overlap.
    - b. Jacket: PE, bonded to shield.
- D. Manufacturers:
1. General "Air Core ALPETH (Spec 2101)" series cables.
  2. Belden "Exchange Cable, Alpeth Cable For Aerial Installations" series cables.
  3. Superior Essex "SEALPIC" series cables.

## 2.3 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; shield bond connector for cables 100-pair or larger
    - c. #4460-D; shield bond connector for cables 100-pair or smaller
    - d. #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; shield bond connector for cables 100-pair or larger
  - c. #4460-D; shield bond connector for cables 100-pair or smaller
  - d. #25T Ground Braid or #25T Ground Braid with Eyelets

**C. Splice Closure – Aerial Type, Straight Splice**

1. Application: Splice closure system shall be suitable for outdoor installation in an aerial installation for straight splicing of OSP cables.
2. Manufacturer: 3M Telcom, or equal:
  - a. #BA/SES, SliC aerial closure with attached bond assembly, 2" x 19", for up to 100 pair.
  - b. #BA/SES, SliC aerial closure with attached bond assembly, 3" x 19", for up to 200 pair.
  - c. #BA/SES, SliC aerial closure with attached bond assembly, 3" x 33", for up to 400 pair.

**D. 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.

**2.4 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.

## 2.5 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. SYSTIMAX #190A1-100 (102 995 099); 100-pair 190 type BEP terminal
    - c. SYSTIMAX #190A1-50 (102 995 073); 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. SYSTIMAX #4C1S (104 386 545); solid state module, 220V – 300V breakdown voltage with sneak current protection, black.

## 2.6 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 approved equivalent.
    - 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**

### **3.1 GENERAL**

- A. Comply with Division 1 General Execution requirements.
- B. Install products, components, accessories, hardware, etc, according to the manufacturer's instructions.

### **3.2 EXAMINATION**

- A. Pathways: Prior to installation, verify pathways (underground conduits, etc.) are complete and ready for cables.
- B. Equipment Rooms: Prior to installation, verify equipment rooms are complete and ready for cables, splice closures and/or BEP terminals.

### **3.3 PREPARATION**

- A. Verify cable is fully operational – both cable sheath and conductors – prior to installation.
- B. Pre-installation testing as described in the Communication Cable Testing specification, is not required and shall be the responsibility of the Contractor.

### 3.4 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. Maintain maximum conductor length of 1,500 meters from the termination at the MDF to the termination in any IDF.
  - b. Install cables within designated pathways.
  - c. Route cables a minimum of 6" away from power sources to reduce interference from EMI.
  - d. When routing vertically within telecom rooms, properly fasten the cable to the cable runway mounted vertically on the wall. "Properly fasten" shall consist of cable ties in a 'crossed' configuration per cable or cable bundle (up to three cables) every 24 inches on center.
  - e. When routing horizontally within telecom rooms, utilize the overhead cable tray / cable runway. Route all backbone cables to avoid crossing over horizontal cabling or horizontal cabling crossing backbone cabling.
4. Termination
  - a. Provide a 10 foot (minimum) sheathed cable slack loop at each end of the run. Store the slack in the overhead cable tray / cable runway.
  - 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 TIA-607 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 TIA-607 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.

### 3.5 LABELING

#### A. General Requirements

1. Identifier assignment and scope of labeling shall conform to TIA/EIA-606. Label colors shall conform to TIA/EIA-606.

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 B01-TDA-B02-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 B01-TDA".

**3.6 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.

**3.7 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.

**3.8 CERTIFICATION**

- A. Provide the Owner, or Owner's Representative, with a written form of acceptance for signature.

**END OF SECTION**



# - SECTION 27 13 24 - TELECOMMUNICATION BACKBONE OSP FIBER CABLING

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## **PART 1 - GENERAL**

### **1.1 RELATED DOCUMENTS**

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

### **1.2 SUMMARY**

- A. Section includes: Backbone outside plant (OSP) fiber optic cabling.
- B. Related Sections
  - 1. Comply with the Related Sections paragraph of Section 27 00 00.
  - 2. Section \_\_\_ - <Telecommunications> Underground Pathways
  - 3. Section 27 05 28 - Telecommunications Building Pathways
  - 4. Section 27 08 00 - Telecommunications Testing
- C. Products Furnished and Installed Under Another Section:
  - 1. Conduits, pullboxes, and other underground pathways.

### **1.3 REFERENCES**

- A. Comply with Division 1 References requirements.

### **1.4 DEFINITIONS**

- A. Refer to Division 1 for Definitions.
- B. In addition to those terms listed in Division 1, 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



## 1.5 SYSTEM DESCRIPTION

- A. General
  - 1. Refer to Division 1 for a full description of the project and building.
- B. Base Bid Work
  - 1. Base bid 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 base bid work, unless otherwise noted.
  - 3. The Drawings are diagrammatic in nature.
  - 4. In general, the base bid 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.

## 1.6 SUBMITTALS

- A. Comply with Submittal procedural, quantity, and format requirements of Division 1.
- 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.
- 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.

## 1.7 QUALITY ASSURANCE

- A. Comply with Quality Assurance requirements of Division 1

## 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.

**1.8 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. The OSP cabling shall be warranted under the minimum Project warranty. Refer to Division 1 for requirements.

**PART 2 - PRODUCTS****2.1 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®), 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. Sheath:

1. Sheath shall consist of central member (as applicable), strength member, inner jacket (as applicable), armor, and an outer jacket.
2. Strength Member: Aramid yarn (e.g., Kevlar®), or reinforced fiberglass rods.
3. Armor: corrugated aluminum tape
4. Jacket: UV-resistant and listed OFCR and FT-4; meets National Electrical Code (NEC Article 770)
5. Rated tensile load: 600 lb. maximum rated load.
6. Operating Temperature Range: -40 to 158°F (-40 to 70°C)

G. Manufacturer: Corning Cable Systems, or equal.

1. #012EW4-T4101D20; 12 strand singlemode outdoor 'ALTOS' dielectric sheath
2. #024EW4-T4101D20; 24 strand singlemode outdoor 'ALTOS' dielectric sheath
3. #012EWC-T4101D20; 12 strand singlemode outdoor 'ALTOS' armored sheath
4. #024EWC-T4101D20; 24 strand singlemode outdoor 'ALTOS' armored sheath

## 2.2 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
  - c. #MFA-SC06-AQ; adapter plate – 6 simplex SC multimode adapters, aqua

### 2.3 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.

### 2.4 MISCELLANEOUS COMPONENTS

- A. Backbone Interbuilding Fiber Optic 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. Fiber Slack Storage Reel: Leviton #48900-OFR, Condux or equal.
- C. 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. Manufacturers: Panduit
    - a. #HLS-15R-0 Black, 15' roll, cut to length.

### 2.5 OUTSIDE PLANT DUCT PLUGS

- A. Innerduct plugs
  1. Manufacturer: Tyco, or equal by Carlon:
    - a. #10S035S; 1-inch fiber optic simplex plug
    - b. #11S057SB; 1 ¼-inch fiber optic simplex plug
    - c. #10D104U; 1-inch blank plug

- d. #12D148U; 1 ¼-inch blank plug

## **PART 3 - EXECUTION**

### **3.1 GENERAL**

- A. Comply General Execution requirements of Division 1.

### **3.2 EXAMINATION**

- A. Pathways: Prior to installation, verify pathways (conduits, etc.) exist and are 'ready' to accept cables.
- B. Equipment Rooms: Prior to installation, verify telecom rooms are 'ready' to accept the backbone cables and terminations.

### **3.3 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.

### **3.4 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. Maintain maximum cable length of 1,500 meters from the termination at the MDF to the termination in any IDF.
  - b. Route cables in conduit/innerduct/multi-guard between points of termination throughout entire length (except at the fiber take up reel).
  - c. Install cables within designated pathways.
  - d. Neatly dress and organize cables using designated cable routing facilities, and fasten to support devices via tie wraps or Velcro-type straps.
  - e. When routing horizontally within telecom rooms, utilize the overhead cable tray/runway. When routing vertically within telecom rooms, utilize the wall mounted vertical cable runway 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.
  - f. Secure cabling to communication vault sidewall by use of racking. Provide racking if not already present in vault.
  - g. Place and suspend cables in a manner to protect them from physical interference or damage.
  - h. 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. Properly strain relieve cables at termination points (at/within the fiber optic termination panels) per manufacturer's instructions.
  - b. 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.
  - c. Provide required tools, consumables and accessories for complete termination of fiber strands.
  - d. Provide 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.
- C. Fiber Optic Cable Termination Panel
- 1. Provide the termination panel in designated equipment rack; per drawings (if not shown, locate at the top of inside rack).

2. Provide accessories required for proper installation of each termination panel, including connector panels and adapters.

### 3.5 LABELING

#### A. General Requirements

1. Labeling and identifier assignment shall conform to the TIA/EIA-606 Administration Standard and as approved by Owner's Representative before installation. Label colors shall conform to the TIA/EIA-606 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.
- 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. Backbone OSP Fiber Optic Cables
  - a. First field shall identify the originating termination room identifier as shown on the plans; for example, "B01-TDA".
  - b. Second field shall identify the ending termination room identifier as shown on the plans; for example, "B02-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: "B01-TDA- B01-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 B01-TDA".

### 3.6 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 -****TELECOMMUNICATION HORIZONTAL CABLING**

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**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. Section Includes: Horizontal Cabling (subsystem of Telecommunications Cabling Infrastructure).
- B. Related Sections
  - 1. Comply with the Related Sections paragraph of Section 27 00 00.
  - 2. Section 27 05 28 - Telecommunications Building Pathways
- 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.

**1.3 REFERENCES**

- A. Comply with the References requirements of Section 27 00 00.

**1.4 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

## 1.5 SYSTEM DESCRIPTION

- A. Base Bid 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 bid work, unless otherwise noted.
- B. In general, the base bid work includes:
  1. Preconstruction Submittals.
  2. Horizontal cables, terminations, and outlets.
  3. Cable management.
  4. Patch cords and cross-connects.
  5. Cable identification tags and system labeling.
  6. Record Documents.
  7. Warranty.

## 1.6 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. Typical Outlet Sample, including faceplate, faceplate label, connectors/jacks, port labels, cables (about 12" sample), and cable label.
- C. Closeout Submittal Requirements:
  1. As-Built Drawings.
  2. Cross-connection records/cut sheets.
  3. O & M Manuals.

## 1.7 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.

## 1.8 DELIVERY, STORAGE AND HANDLING

- A. Comply with the Delivery, Storage and Handling requirements of Section 27 00 00.

## 1.9 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

## 2.1 SUBSTITUTIONS

- A. Comply with the Substitutions requirements of Section 27 00 00.

## 2.2 HORIZONTAL CABLE

- 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

### 2.3 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)

### 2.4 CROSSCONNECT WIRE

- A. Application: Suitable for indoor installation within a 110-based crossconnect system. Each and every crossconnect wire shall be manufactured from a single, continuous length of insulated wire, homogenous in nature. Splices are not permitted anywhere.
- B. Factory splices of insulated conductors are expressly prohibited.
- C. Conductors:
  - 1. Insulated Conductors: Conductors shall be 24 AWG solid copper. Conductors shall be fully insulated with a flame retardant thermoplastic material (such as PVC, or equivalent).
  - 2. Twisted Pairs: Two insulated conductors shall be "twisted" into a "pair" (twisted pair). Twisted pairs shall be individually color coded.
- D. Manufacturer: General, or equal
  - 1. #7041973; crossconnect wire, 1 pair, Whi-Red / Red-Whi
  - 2. #7042047; crossconnect wire, 1 pair, Whi-Blu / Blu-Whi

**2.5 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

**2.6 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.
- C. Faceplate for Open Office Furniture Outlets
  - 1. Application: Faceplate shall be compatible with the baseplate and beltway of the selected open office furniture, and shall “snap” into the furniture opening.
  - 2. Faceplate shall have 4 ports.
  - 3. Manufacturer (example – confirm open office system): Panduit
    - a. #CFFPL4BL; snap-on faceplate for open office furniture, 4-port
- D. Adapters for Raceway Mount Outlets
  - 1. Application: Adapter / module insert shall be compatible with the surface raceway opening designated for telecom use. Refer to the Outlet Schedule of the Drawings for additional information. Refer to the electrical drawings for raceway information.
  - 2. Manufacturer: Panduit #CH02MEI-X; module insert for raceway
  - 3. Color shall match electrical device and/or coverplate.
- E. Adapters for Poke-Thru Devices

1. Application: Adapter / module insert shall be compatible with the poke-thru device. Refer to the Outlet Schedule of the Drawings for additional information. Refer to the electrical Drawings and Specifications for poke-thru device information.
2. Manufacturer: Panduit #CH02MEI-X; module insert for Wiremold "Open Systems" devices
3. Color shall match electrical device and/or coverplate.

## 2.7 CONNECTORS / MODULAR 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

## 2.8 COURTESY/CAMPUS PHONE

- A. Indoor, wall-mount type: Allen Tel #GB306V

## 2.9 WIRELESS LAN ACCESS POINT ENCLOSURE

- A. Indoor ceiling-mount type: Oberon #1055
- B. Indoor wall-mount type: Oberon #1023-00

## 2.10 LABELS

- A. Labels shall be machine printable with a laser printer, ink jet printer, thermal transfer printer, or hand-held printer.
- B. Horizontal 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. Outlet 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. Modular Patch Panels
  - 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
  
- E. 110 Termination Block Labels
  - 1. Color: Blue for horizontal termination field.
  - 2. Manufacturer, or equal: Panduit
    - a. #DSL110-BU; label inserts, blue

## 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

### 3.1 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.

### 3.2 EXAMINATION

- A. Pathways: Prior to installation, verify pathways are complete and ready for cables.
- B. Equipment Rooms: Prior to installation, verify equipment rooms are complete and ready for cables.

### 3.3 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. When routing horizontally within Telecommunications Room, utilize the overhead cable support. When routing vertically within Telecommunications Room, fasten the cable bundles using approved cable ties to the wall-mounted vertical cable support every 24 inches on center.
    - b. Route cables a minimum of 6" away from power sources to reduce interference from EMI.
    - c. When routing cables in areas without primary horizontal pathways, install cables onto secondary pathways or approved support devices, such as cable hangers.
    - d. 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.
    - e. Provide a 10 feet (minimum) sheathed cable slack loop at each end of the run. In the Telecommunications Room, place the slack in the overhead cable support. At the workstation, place cable in ceiling space before the device conduit stub supported from a cable hanger.
    - f. Provide six inches (minimum) 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.
    - g. At the equipment bay in the Telecommunications Room 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. At the equipment bay in the Telecommunications Room where wall-mounted racks are used, route the horizontal cables down the hinged side of the equipment rack.
  5. Termination
    - a. Properly (per manufacturer's instructions and TIA/EIA-568-B standard installation practices) strain relieve cables at termination points.
    - b. Terminate pairs on the specified connecting hardware. 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 IDF.

2. Install the discrete patch panels and horizontal management panels in the configuration as shown on the Drawings. Install panels level.
- 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. Refer to Telecommunications Outlet Schedule of the Drawings for cord (workstation, Telecom Room, and other) patching and crossconnecting requirements.
  2. Splices in patch cords and crossconnect wire are prohibited.
  3. Record crossconnections in IDFs for MDF crossconnection purposes and for record documents.
  4. Color:
    - a. For digital handsets, provide: White-Blue / Blue-White
    - b. For analog handsets, provide: White-Red / Red-White

### 3.4 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. Horizontal 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.
- 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.

### 3.5 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 27 5113 -**

# **EVENT ANNUNCIATION SYSTEM-BUILDING DISTRIBUTION**

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## **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 penetrating water-repellent coatings for the following vertical and horizontal surfaces:
  - 1. Concrete (unpainted).
- B. Section Includes: event annunciation system's building distribution (subsystem of the EAS).

### **1.3 RELATED SECTIONS**

- A. Comply with the Related Sections paragraph of Section 27 00 00.

### **1.4 REFERENCES**

- A. Comply with the References requirements of Section 27 00 00.

### **1.5 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. "EAS": Event Annunciation System
  - 2. "CL2P": Class 2 Power Listed Circuit Plenum, plenum rating
  - 3. "CMP": Communications Media Plenum, plenum rating; synonymous with "MPP"

### **1.6 SYSTEM DESCRIPTION**

- A. Other System Elements

1. SMCCCD intends to use the existing carillon systems at **College of San Mateo** as the EAS headend.
  2. SMCCCD will provide amplifiers per building in the TDx rooms, where the loudspeaker wiring originates.
- B. Base Bid Work
1. Provide engineering, labor, materials, apparatus, tools, equipment, and transportation required to complete the building distribution segment of the District's event annunciation system throughout designated spaces within campus buildings, and as described in these specifications.
  2. Consider wiring/cabling and loudspeakers to be base bid work, unless otherwise noted. Amplifiers shall not be base bid work.
- C. Loudspeaker Criteria
1. Selection Guidelines: The following list offers guidelines for selecting the appropriate loudspeaker type per instance to be noted on shop drawings for approval by the District.
    - a. For indoor spaces with lay-in tile suspended ceilings (such as corridors), provide indoor ceiling-mount type loudspeaker.
    - b. For indoor spaces with no ceilings (such as stairwells, lobbies, and corridors with no ceilings), provide indoor wall-mount type loudspeaker.
  2. Placement Guidelines: The following list offers guidelines for the installer to locate loudspeakers on shop drawings for approval by the District.
    - a. In public corridors, equal to or less than 10 feet wide and 10 feet high, provide loudspeakers spaced approximately 30 feet apart. Attempt to locate loudspeakers near exits and elevators.
    - b. In stairwells, provide at least one loudspeaker per stairwell located on the middle landing.
    - c. In vestibules or other areas fully enclosed either in normal conditions or a fire and/or emergency event, provide one loudspeaker per 250 square feet.
    - d. Do not provide loudspeakers in classrooms (lecture, lab, etc.) and offices.
- D. In general, the base bid work includes:
1. Preconstruction Submittals
  2. Cabling/Wiring
  3. Supplemental pathway devices and cable management
  4. Loudspeakers
  5. Cable identification tags and system labeling
  6. Record Documents
  7. Warranty

## 1.7 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 listings, certifications and specifications

2. Shop Drawings Submittal, consisting of proposed loudspeaker locations and cable routing

C. Closeout Submittal Requirements:

1. As-Built Drawings

### 1.8 QUALITY ASSURANCE

- A. Comply with the Quality Assurance requirements of Section 27 00 00.

### 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Comply with the Delivery, Storage and Handling requirements of Section 27 00 00.

### 1.10 WARRANTY

- A. Warrant wiring/cabling and loudspeakers for a period of 2 years. Warranty period shall begin upon SMCCCD's written acceptance of system installation.

## PART 2 - PRODUCTS

### 2.1 SUBSTITUTIONS

- A. Comply with the Substitutions requirements of Section 27 00 00.

### 2.2 AUDIO CABLE

- A. Application: Suitable for indoor installation within closed ceiling space or open corridors.
- B. Wires: Wires shall be 14 AWG stranded copper, fully-insulated with a flame retardant thermoplastic material (PVC, or equivalent), and individually color-coded
- C. Shield: The cable shall have one foil/tape shield fully covering the wires.
- D. Outer Jacket: The cable shall be sheathed with a seamless thermoplastic (LS-PVC, or similar) jacket applied to and completely covering the internal components (wires and shield).
- E. Flame Rating: NEC (Article 725) rated as CL2P or NEC (Article 800) rated as CMP, and UL listed as such.
- F. Manufacturer: Belden #6100FE, or equal

### 2.3 LOUDSPEAKER – INDOOR CEILING-MOUNT TYPE

- A. Suitable for indoor installation within closed ceiling space into corridors.
- B. Finish shall be flush with ceiling tile, including trim ring

- C. Manufacturer:
  - 1. Bogen #HFCS1LP, enclosed ceiling-mount loudspeaker
  - 2. Bogen #TBCR, tile bridge support ring
  - 3. Bogen #CK10, safety cable kit

#### **2.4 LOUDSPEAKER – INDOOR WALL-MOUNT TYPE**

- A. Suitable for indoor wall-mount installations, such as stairwells and/or corridors with no ceilings.
- B. Manufacturer: Bogen #MB8TSLVR

#### **2.5 LOUDSPEAKER – OUTDOOR SURFACE-MOUNT TYPE**

- A. Suitable for outdoor installation for open spaces
- B. Loudspeaker shall be horn type
- C. Manufacturer: Bogen #KFLDS30T

#### **2.6 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: Panduit #LJSL7-Y3-1, or equal

#### **2.7 MISCELLANEOUS MATERIALS**

- A. Cable Hangers
  - 1. Application: Suitable for indoor installation within ceiling space for the support of cables.
  - 2. Listings: UL 2043, for use in air handling spaces
  - 3. Manufacturers (or variation per installation method): B-Line #BCH12-W2, or equal
- B. 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**

### **3.1 GENERAL**

- A. Comply with the Execution requirements of Section 27 00 00.
- B. Install products, components, accessories, hardware, etc, according to local, state, and federal codes, and per the manufacturer's instructions.

### **3.2 EXAMINATION**

- A. Pathways: Prior to installation, verify route and capacity of existing pathways, and ready for new cables.

### **3.3 INSTALLATION**

- A. Loudspeaker – Indoor Ceiling-Mount Instances
  1. Cut ceiling tile such that no visible cuts and/or openings are visible after installation of loudspeaker and trim.
  2. Provide one bridge support ring per loudspeaker spanning the "T-bar" of the suspended ceiling system.
  3. Provide one safety cable per loudspeaker attached to building structure for seismic bracing. Provide accessories, such as power-actuated masonry fasteners, to attach safety cable to structure.
    - a. Obtain written approval from SMCCCD of fastening component prior to installation.
- B. Loudspeaker – Indoor Wall-Mount Instances
  1. Coordinate the loudspeaker's installation location with cable route to minimize the route of surface-mounted raceway and cable (minimize the length of 'exposed' raceway and cable).
  2. Locate loudspeaker at least 8 feet 6 inches above finished floor in public spaces such as corridors. Locate loudspeakers at least 6 inches from nearest obstruction (soffit, duct, etc.).
  3. No loudspeaker shall block visibility to an exit sign. The Contractor shall relocate loudspeakers at SMCCCD's discretion should the installed conditions potentially violate code.
  4. Attach loudspeaker to surface using fasteners appropriate for the substrate; for example, provide masonry fasteners (screws such as Tap-Con) for concrete walls.
- C. Pathways
  1. Utilize existing pathways to the maximum possible extent.
  2. Where necessary, provide supplemental pathways devices such as cable hangers.
  3. Where cables route on exposed walls, provide metallic surface raceway. Attach raceway to surface using fasteners appropriate for the substrate; for example, provide masonry screws for concrete walls.



D. Loudspeaker Cable

1. General

- a. Cable runs shall have continuous sheath continuity, homogenous in nature. Splices are not permitted anywhere.
- b. Provide at least one cable run per floor. If the building's layout/floor plan will not allow a single run per floor in a logical manner, then provide two runs on that floor(s).
- c. Connect the audio cable to the loudspeakers in a parallel wiring configuration.

2. 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.
- f. Place cables onto/into pathways or approved support devices, such as cable hangers. Do not strap and/or cable tie cables to the outside of existing pathways (which is a code violation) and to ceiling support wires.

3. Routing

- a. Route cables a minimum of 6" away from power sources to reduce interference from EMI.
- b. 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.
- c. Within Telecommunications Rooms:
  - 1) Routing horizontally, utilize the overhead cable support.
  - 2) Routing vertically, fasten the cable bundles using approved cable ties to the wall-mounted vertical cable support every 24 inches on center.
- d. Provide a 10 feet (minimum) sheathed cable slack loop at the telecommunication room end of the run (for future termination).

**3.4 LABELING**

- A. Labels shall be permanent with machine-generated text; hand-written labels will not be accepted.
- B. Text Attributes:
  - 1. Black,
  - 2. 1/8" high, minimum, or #12 font size.
  - 3. Font: Verdana preferred; SansSerif or Arial acceptable.
- C. 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.
- D. Label Content: Labels shall display the building and floor, and (if applicable) the run number.

**3.5 FINAL INSPECTION**

- A. Inspect installed products and work in conjunction with SMCCCD. Develop a punch list for items needing correction.
- B. Issue punch list to the SMCCCD for review prior to SMCCCD performing their punch walk.
- C. Repair defects prior to system acceptance.
- D. Inspect installed products and work in conjunction with SMCCCD for sign off

**- END OF SECTION -**



**- SECTION 27 5313 -**

**TELECOMMUNICATION CENTRAL CLOCK  
SYSTEM**

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**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. The San Mateo County Community College District utilizes central clock systems that provide synchronized timepieces throughout its three Colleges and the District Administration Building. The use of these systems realizes substantial savings for the District in terms of operation, maintenance and usage. This document defines design standards, necessary equipment and protocols to effectively utilize these systems.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Simplex 6351 Master Clock Head End
  - 1. Design Standard
    - a. All buildings must have field clocks tied to the Simplex 6351 master clock system.
    - b. Clocks must be in classrooms, laboratories, large public gathering spaces, conference rooms, gymnasias, and libraries.
    - c. Classroom clocks should be located on the side wall, so that both faculty and students can see the time.
    - d. There may be other areas where clocks are appropriate as well; design teams must confirm clock locations with the District's design phase project manager no later than the design development phase of the project.
  - 2. Features
    - a. The 6351 has a number of new features:
      - 1) Power Outage: the 6351 has a 60 day battery standby and will maintain the correct time for 60 days.

- a) When a/c power is restored, the 6351 will start updating the field clocks. Within 24 hours all of the field clocks will register the correct time. In most cases this will be done within the first hour after the restoration of a/c power.
- 2) Time Display: The 6351 can use either 12 or 24 hour time display. -The Time display is no longer in Julian time.
- 3) Clock Types: The 6351 can support both analog clocks and digital clocks.
- 4) Automatic Daylight Saving time adjustment.
  - a) Once a year the correct spring and fall adjustment dates and times must be programmed into the 6351. Once programmed, the 6351 will make the proper time adjustments automatically.

**END OF SECTION**

# DIVISION 28 – ELECTRONIC SAFETY & SECURITY

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**- SECTION 28 0000 -****BASIC SECURITY REQUIREMENTS**

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**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 general administrative and procedural requirements for Sections numbering 28xxxx, 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. Related Sections:
    - a. Section 078400: Firestopping
    - b. Section 087100: Door Hardware
    - c. Section 081000: Doors and Frames
    - d. Section 281300: Access Control & Alarm Monitoring System
    - e. Section 282300: Video Surveillance System
    - f. Section 280513: Security System Cabling
    - g. Section 280553: Security System Labeling
    - h. Section 280800: Security System Commissioning
    - i. Section 142400: Hydraulic Elevators
    - j. Section 260529: Hangers and Supports for Electrical Systems
    - k. Section 260533: Raceway and Boxes for Electrical Systems
    - l. Section 210900: Instrumentation and Control for Fire-Suppression Systems
  3. General and Supplementary Conditions: Drawings and general provisions of Contract and Division 1 of the Specifications, apply to 28xxxx series Sections.



### 1.3 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. National Electric Code (NEC), NFPA 70.
  - 2. California Code of Regulations (CCR) Title 24, California Building Standards Code Part 2, Basic Building Regulations and Part 3, California Electrical Code (CEC).
  - 3. Uniform Building Code (UBC).
  - 4. Uniform Fire Code (UFC).
  - 5. Uniform Mechanical Code (UMC).
  - 6. National, State, Local and any other binding building and fire codes.
  - 7. FCC Regulations:
    - a. Part 15 – Radio Frequency Devices & Radiation Limits
  - 8. Underwriter's Laboratories (UL): Applicable listing and ratings.
    - a. UL 294: Access Control System Units
    - b. UL 1076: Proprietary Burglar Alarm Units and Systems
  - 9. EIA testing standards
- C. Make a copy of each document readily available during the course of construction for reference by field personnel.

### 1.4 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. "Furnish": To purchase, procure, acquire, and deliver complete with related accessories.
  - 2. "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.
  - 3. "Provide": To furnish, transport, install, erect, connect, test and turn over to the Owner, complete and ready for regular operation.
  - 4. "Connect": To install all required patch cords, equipment cords, cross-connect wire, etc. to complete an electrical or optical circuit.
  - 5. "As directed": As directed or instructed by the Owner, or their authorized representative.
  - 6. "Cabling": A combination of all cables, wire, cords, and connecting hardware [e.g., cables, conductor terminations, connectors, outlets, patch panels, blocks, and labeling].

7. "ACAMS": Access Control & Alarm Monitoring System
8. "SEC": Security Equipment Panels
9. "VSS": Video Surveillance System

## 1.5 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.

## 1.6 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., "CSM").
    - 2) Project Number and Contract Number.
    - 3) Project Name and Address (e.g., "Building 9").
    - 4) Contractor's Submittal Number.
    - 5) Submittal Title (e.g., "Product Data Submittal For ACAMS System").
    - 6) Specification Section Number (e.g., "Section 13710").
    - 7) Date of Submittal. Format: <month> <day>, <year> (e.g., "January 1, 2007").
    - 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 Release 14 or later.
  - b. Use the same sheet size and project title block as the Drawings.

- c. Text a minimum of 3/32" high 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: Record 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) Four half-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 Release 14 or later.
  - b. Use the same sheet size and project title block as the Drawings.
  - c. Text a minimum of 3/32" high 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) SMCCCD 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, 2007").
- 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 Manual which includes:
    - 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.
    - 4) Manufacturer's warranty certificates.
  - e. 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.

## 1.7 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.

## 1.8 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.

## BASIC SECURITY REQUIREMENTS

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.

## 1.9 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

**1.10 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, punchlist 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**

### **3.1 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.

### **3.2 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.

### **3.3 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.

### 3.4 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**

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**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. 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 280000: Basic Security System Requirements.
  - 3. Section 281300: Access Control and Alarm Monitoring System
  - 4. Section 282300: Video Surveillance System
  - 5. Section 280553: Security System Labeling
  - 6. Section 280800: Security System Commissioning
  - 7. Section 078400: Firestopping
  - 8. Section 260533: Raceways and Boxes

**1.3 SUBMITTALS**

- A. Submit in accordance with the requirements of Section 280000: Basic Security System Requirements, the following items:
  - 1. Product Data

## PART 2 - PRODUCTS

### 2.1 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

#### C. Or Equal

#### D. 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
2. Provide self-adhesive flat tapewire on all existing wood doors for lock power transfer from hinge to lock.
  - a. Install tape wire in routed channel along edge of door
  - b. Fill channel with silicone after lock has been tested
  - c. Manufacturer: Taperwire 222-CL.
  - d. Refer to architectural details and section 8212 Flush Wood Doors for additional information
  - e. Power locks to ensure continuity of circuit
  - f. Refer to Section 08710 and door schedule in Section 13710 for locations

#### E. Video Surveillance System

**Provide plenum rated cable by Westpenn, Belden, Commscope, or equal**

- a. #18-2 AWG unshielded: camera power

### SECURITY SYSTEM CABLING

2. Provide minimum RG-59/U CCTV video coaxial cable between the camera and the monitoring equipment, with the following features:
  - a. 95% percent copper braid
  - b. Foam dielectric
  - c. Solid copper core
  - d. 75 ohm characteristic impedance
  - e. Plenum jacket
3. Manufacturer: West Penn #25815
4. Provide West Penn #825 with a black jacket for CCTV video cross-connect/patch cabling under 15' in length.

## 2.2 SURFACE MOUNTED RACEWAY

### A. General

1. Surface mounted raceways are required at card reader doors that are set in existing concrete openings and the opportunity for concealed in wall conduit is not available.
2. Provide surface mounted steel raceways according to door details and where devices are visible and no accessible ceiling exists.
  - a. Exceptions include MEP spaces and IT rooms.
3. Fasten raceway to concrete with ¼" TAPCON anchors or approved equal
4. Size raceways to accommodate feeder cables to junction box at doors and from junction boxes to devices
5. Manufacturer: Wiremold V500/V700 & V4000 Raceways
  - a. Use combinations of series to accommodate cable fill and junction boxes.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. 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.
- B. 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.
- C. All wire and cable shall be continuous and splice-free for the entire length of run between designated connections or terminations.

- D. Make all connections to screw-type barrier strips on panels and with insulated crimp-type spade lugs when appropriate. Size all lugs properly to assure high electrical integrity, i.e., low resistance connections.
- E. 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.
- F. Wiring for shielding certain conductors from others or routing in separate raceways, shall be as recommended by the manufacturer's current requirements.
- G. All 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.
- H. Provide all necessary tie wires.
- I. Label all cables at both ends of a run and within all pull and junction boxes using machine generated wrap-around labels.
- J. Follow manufacturers recommended guidelines for installation.

**END OF SECTION**

**- SECTION 28 05 53 -****SECURITY SYSTEM LABELING**

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**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. 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 280000: Basic Security System Requirements
  - 3. Section 281300: Access Control & Alarm Monitoring System
  - 4. Section 282300: Video Surveillance System
  - 5. Section 280513: Security System Cabling

**1.3 SUBMITTALS**

- A. Submit in accordance with the requirements of Section 280000: 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**

### **2.1 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**

### **3.1 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.

### 3.2 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:
    - 1) CR 001
    - 2) ACU 1 – KP5
  - d. Standard Device Types
    - 1) KP = Keypad

- 2) R = Relay Output
- 3) A = Alarm Point
- e. Standard Port #
  - 1) M = Monitored Input
  - 2) R = Relay Output
- 3. Miscellaneous Examples:
  - a. From Panel to Door Contact
    - 1) A001
    - 2) D.C.
  - b. From Panel to Glass Break.
    - 1) A001
    - 2) GB PWR
    - 3) 12 VDC
- 4. Communications Cable
  - a. Line 1: Communication Type and Direction
  - b. Line 2: Panel ID
  - c. Example:
    - 1) 20MA TO
    - 2) ACU 2
  - d. Typical Communication Types
    - 1) 10BASE-T
    - 2) RS485
    - 3) RS 232
    - 4) RS 422
    - 5) 20mA

**END OF SECTION**

**- SECTION 28 08 00 -****SECURITY SYSTEM COMMISSIONING**

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**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 SCOPE OF WORK**

- A. General: Furnish 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. Final walk test with the Owner
    - c. 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 280800: Basic Security System Requirements.
  - 3. Section 281300: Access Control and Alarm Monitoring System (ACAMS)
  - 4. Section 282300: Video Surveillance System

**1.3 SUMMARY OF SYSTEM COMMISSIONING ACTIVITIES**

- A. Overview
  - 1. The purpose of system commissioning is to ensure the security system operates properly when it is needed most. 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.

#### 1.4 SUBMITTALS

- A. Submit in accordance with the requirements of Section 280000: 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
    - b. Hardware Manual
    - c. Software Manual which includes
    - d. Operator's Manual which full explains all procedures and instructions for the operation of the system and includes
    - e. Maintenance Manual
    - f. Test Results Manual, which includes the document results of all tests, required under this Specification, organized by System, Floor, and Door.
    - g. Record Drawings Manual
  - 3. Record Drawings:
    - a. Submit for review and comment at the completion of the project:
    - b. Final acceptance will not be made until the record drawings approved by the Owner.

#### 1.5 QUALITY ASSURANCE

- A. General
  - 1. All testing work shall be completed in a neat, high quality manner acceptable to the Owner.
- B. Project Management and Coordination Services
  - 1. Provide a project manager to coordinate the security system commissioning work with all other trades.

## **PART 2 - PRODUCTS (NOT USED)**

## **PART 3 - EXECUTION**

### **3.1 SCHEDULING**

- A. Prepare a construction schedule based on the schedule developed in Section 280000 for the testing activities. Prepare updated schedules whenever there are modifications.

### **3.2 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. Card Reader/ADA Test: Test doors according to card reader test above. In addition, test ADA push plate interlocking function to ensure door does not operate when locked. Test that interior ADA actuator always functions.
    - c. Card Reader/ Holder Test: Test doors according to card reader test above. In addition test magnetic holder interlock function to ensure doors cannot be propped when locked
    - d. Elevator In-Cab Reader Test: Enable after hours scheduled securing of elevator floor select buttons. Program a card for each floor with only one-floor privileges. Present card 1 and select floor each floor one at a time. Floor 1 shall function while other floors should not. Repeat test with other cards and floors.
    - e. Elevator Hall-Call Reader Test Enable after hours scheduled securing of elevator. Program single card with privileges to all hall select buttons. Present card at floor 1 and press hall select button. Hall select button should function. Have second technician attempt to use hall button on other floors at same time to ensure independent operation.
    - f. In/Out Card Reader Test: Test door according to card reader test above. In addition test door management alarm for instant alarm on forced exit/entry, remote reset recycle upon card presentation for authorized passing through door. Door held function post authorized card presentation.
    - g. 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

- h. CCTV Recording System Test: Test the recording system for correct programming, alarm recording, and event retrieval. Verify correct integration with the ACAMS system for alarm call-up. Test and verify CCTV system viewable from workstations.
  - i. Security Equipment Room Test: Inspect all system panels, power supplies, and other related security equipment located in these areas.
  - j. Access Control: Test the software for correct programming and setup to activate door schedules, elevator interface and test cards.
- B. Test Preparation
- 1. Provide device identification numbers that differ from or were not included on the original contract drawing set.
  - 2. Furnish a complete systems point list.
  - 3. Furnish 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.

### 3.3 TEST PROCEDURES

- A. Prepare and issue for review test forms for each door and device type.

### 3.4 DOCUMENTATION

- A. Provide a full-sized blueline 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.

### 3.5 DEMONSTRATION

- A. On completion of the acceptance test, provide the Owner instruction in the operation and testing of the system, at a time convenient to them.
- B. Utilized 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
- D. 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 1300 -****ACCESS CONTROL & ALARM MONITORING  
SYSTEM**

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**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. General: Furnish 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 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 fire life safety system magnetic door release service
  6. Interface to elevator control system
  7. Interface to central station alarm monitoring.
- C. Products Supplied But Not Installed Under This Section:
1. Elevator card readers
    - a. Products Installed But Provide card reader to elevator contractor to install on car operating panel
    - b. Remove installed reader and make connections to reader from cable in traveler and remount to existing machine tapped mounting holes.
- D. Products Installed But Not Supplied Under This Section:
1. Exit Device (panic bar) Power Supplies

- E. Products Specified But Not Installed Under This Section:
  - 1. Type 1 enclosures at pull box and elevator junction box locations.
  
- F. Products Furnished and Installed Under Another Section:
  - 1. Local area network.
  - 2. Data cable to network port
  - 3. Voice cable and connections to District
  - 4. 120V power to system
  - 5. Elevator traveler cable for card reader
  - 6. Magnetic door holders
  - 7. Electrified locking hardware.
  
- 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 087100 Door Hardware: includes product information for electrified locking hardware and magnetic door holders.
  - 3. Section 280000 Basic Security Requirements: includes general project requirements, submittal formats, warranty, and installation requirements and additional sections for reference.
  - 4. Section 282300 Video Surveillance System: includes product information for video integration with the ACAMS.
  - 5. Section 280513 Security System Cabling: includes product information for wire and cable needed to support the ACAMS.
  - 6. Section 280553 Security System Labeling: includes label types and formats for security devices.
  - 7. Section 280800 Testing/Commissioning: includes the integrating testing/commissioning requirements for the ACAMS.

### 1.3 SYSTEM DESCRIPTION

- A. Overview
  - 1. Refer to Division 1 and Section 280000 for general description
  
- B. Base Building Access Control & Alarm Monitoring System (ACAMS)
  - 1. The ACAMS system will control access control into the building and select interior doors as indicated on the plans. Intrusion alarm monitoring, comprised of door contacts and glass break detectors, is consolidated to the ACAMS system eliminating the need for a conventional burglar alarm panel.
  - 2. Elevator Access Control:
    - a. Elevator – Hall Call
      - 1) Access is restricted after hours by disabling the hall call buttons on each floor.

- 2) On schedule the hall buttons, through hardwired integration between the ACAMS and elevator controller, will become inactive and unresponsive to calls.
  - 3) Each hall call button on floors to be access controlled will include an adjacent card reader. Valid card readers will momentarily enable the call button for use and call the elevator to that floor.
  - 4) Car Operating Panel floor select buttons are always unrestricted.
- b. Elevator – Interior Elevator
- 1) Access is restricted after hours by disabling the Car Operating Panel floor select buttons
  - 2) On schedule the floor select buttons, through hardwired integration between the ACAMS and elevator controller, will become inactive.
  - 3) A single card reader installed in the elevator on the Car Operating Panel momentarily enables specific floor selection buttons and allows travel to floors
  - 4) Hall call buttons are always unrestricted.
3. Select Interior 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. Exterior perimeter doors are excluded from card commands
  4. In/Out card readers with door management alarms restrict access to select areas of building and maintain separation between leased space and the building common
  5. Create schedules to automate the opening and closing of the building including unlocking doors, bypassing alarms, and unrestricted elevator access.
  6. Connect the ACAMS system to the Districts 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 IT switch located in the building. All downstream panels are hardwired on a 20mA loop.
  7. Provide duress buttons at all public service counters or cash exchange locations. Duress buttons will connect auxiliary inputs on the ACAMS panels.
  8. 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. Interconnect magnetic door holders on select card reader doors to prevent after hours propping (refer to plans for locations).
    - a. Interlock magnetic holder power through control relay on Von Duprin PS-873. Relay automatically follows lock power state.
    - b. When door is locked power to magnetic holders is cut.
    - c. When door is unlocked on schedule, during class hours, power is routed to magnetic holders and door can be propped
    - d. Fire alarms will disconnect power from magnetic holders and release door and is not affected by interconnections to ACAMS.
  2. Connect all low voltage cables between lock power supplies, transfer hinges, and locks.

3. Interconnect ACAMS system to ADA operators for secure after hour's operation as indicated in drawings.
  - a. Interlock exterior ADA push plates with aux relay on PS-873
  - b. When door is locked exterior push plate is disabled
  - c. When door unlocked, even momentarily, ADA push plate is enabled.
- 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.

#### 1.4 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

### 2.1 MANUFACTURERS

- A. Access Control and Alarm Monitoring System

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 Technologies
- C. Power Supplies
  1. Altronix
- D. Intrusion Devices
  1. GE Security
  2. DSI

## 2.2 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. (2) 4DCU
    - c. (4) 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.

### 2.3 MONITOR INPUT/RELAY OUTPUT BOARDS

- A. General
1. 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

### 2.4 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.

### 2.5 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.
3. Manufacturer: AMAG Technologies S830 Micro Proximity Reader, Black or best color to match mounting surface

C. 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: AMAG Technologies S840 Keypad Proximity, Ash Gray or best color to match mounting surface

## 2.6 REQUEST TO EXIT SENSORS (REX)

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: Detection Systems DS160i, Black or best color to match mounting surface



## 2.7 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: Sentrol 1076 1" recessed contacts, mahogany; or approved equal

## 2.8 GLASS BREAK DETECTOR

- A. Provide digital type glass break sensor utilizing DSP technology.
- B. Sensor shall be capable of being mounted on any surface either vertically or horizontally within 25' of glass surface to be protected
- C. Coordinate location with Architectural reflected ceiling plan and other devices in ceiling
- D. Connect glass break alarm signal to input modules on ACAMS panel.
- E. Power glass break detector from auxiliary 12VDC device power supply.
- F. Manufacturer: GE Security Round Acoustic Glassbreak 5812-RND; white; or approved equal

## 2.9 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

## 2.10 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

## 2.11 DOOR MANAGEMENT ALARM

- A. Provide door management alarms at all in/out card reader locations
- B. Alarm shall be equipped with integral Rim Cylinder and keyed to the building standard
- C. Connect door alarms directly to door management alarm.
- D. Provide remote reset/shunt recycle function from card reader alarm bypass output to shunt alarm on valid card presentations
- E. Power alarm from 12 VDC auxiliary power supply at SEC.
- F. Manufacturer
  1. Designed Security Inc; Door Management Alarm ES4200

## 2.12 EMERGENCY EXIT ALARM

- A. Alarm shall be equipped with integral Rim Cylinder and keyed to the building standard
- B. Connect door contacts directly to exit alarm.
- C. Power alarm from 12VDC auxiliary power supply at SEC

- D. Manufacturer:
  - 1. Designed Security Inc; Exit Alarm ES4300

### 2.13 DURESS BUTTONS

- A. Provide under-counter pull type duress buttons at each public service or help counters as indicated on the plans
- B. Coordinate final location for installation prior to owner to ensure they are ergonomically appropriate easily accessed with excessive travel
- C. Provide pathway and route consistent with telecom pathways to counters as well. Security and telecom cable me share the same furniture raceways if required.
- D. Manufacturer:
  - 1. Sentrol 3040

### 2.14 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

### 2.15 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**

### **3.1 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 all power supplies with electrical conduit fittings and junction boxes, plug in transformers and exposed cable is unacceptable.
5. Coordinate Network Data Drop with Telecom contractor inside access controller
6. Coordinate IP address with District IT staff
7. Coordinate Voice connection with District IT department.

#### **B. Field Devices**

1. Homerun all cable from field devices to control panel, utilizing J-Hangers, sleeves and risers for vertical and horizontal cable runs.
2. Provide wiremold surface mounted raceways to devices when concealment of EMT conduit is not possible
  - a. Exception is long multiple cable pathways routing to pull boxes or homeruns.
3. Install devices as indicated on drawings.
4. Use conduit pathways and fish cable as required to final device locations including using storefront mullion as raceways.

#### **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. Elevator Integration
4. Meet with elevator contractor to review scope and delineation of scope
5. Provide functioning relays in demarcation enclosure prior to elevator button cutover to ensure elevator will function with card readers at time of turn-up.
6. Furnish card reader to elevator contractor
7. Coordinate the installation and termination of the card reader inside the cab and in the elevator machine room.

### **3.2 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.

Document the results of the meeting and perform necessary programming to achieve the Owner's requests.

- B. 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.
- C. 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.
- D. 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 1600 -

# INTRUSION DETECTION

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## 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. Intrusion detection with hard-wired, modular, microprocessor-based controls, intrusion sensors and detection devices, and communication links to perform monitoring, alarm, and control functions.

### 1.3 QUALITY ASSURANCE

- A. FMG approved and labeled.

### 1.4 WARRANTY

- A. Materials and Workmanship: one year.

### 1.5 PRODUCTS

- A. Functional Description of System:
  - 1. System Control: Central-station control unit directly monitors intrusion detection devices.
  - 2. Timed control of central-station control unit.
  - 3. Printed record of events.
  - 4. Circuit supervision.
  - 5. Secure-Access Control: Programmable.
- B. System Component Requirements:
  - 1. Existing system compatibility.
  - 2. Surge protection.
  - 3. Interference protection.
  - 4. Tamper protection.
  - 5. Self-testing devices.

- C. Power Continuity for Central-Station Control Unit and Controllers: Rechargeable, recombinant, lead-acid type batteries; with battery charger.
- D. Secure and Access Devices: Keypad and display module.
- E. Door and Window Switches: Balanced-magnetic type.
- F. Intrusion Detection Devices: PIR sensors or microwave intrusion detectors interior .
- G. Central-Station Control Units: Modular, with separate and independent alarm and supervisory modules; UL 609.
  - 1. Alarm Indication: Audible signal and plain-language identification on LED or LCD display at central-station control unit.
  - 2. Timing Unit: Solid state, programmable, 365 days.
  - 3. Alphanumeric display and system controls.
  - 4. Power supply circuits.
  - 5. UPS.
  - 6. Lockable, steel cabinet.
- H. Annunciator: Visual displays, duplicate LEDs, audible alarm, silence-reset switch, UPS, and test switch enclosed in cabinet with two hinged doors.
- I. Central-Station Control Unit:
  - 1. Hardware: Microprocessor, monitor, keyboard, hard disk, floppy disk, CD-ROM, modem, UPS, alarm printer, and report printer.
  - 2. Software: System access control, alarm monitoring, monitor display, system test, and report generator types.
- J. Audible and Visual Alarm Devices: Siren.

## 1.6 INSTALLATION

- A. Installation: UL 681.
- B. Wiring Method: In raceways, except in accessible indoor ceiling spaces and hollow gypsum board partitions; cable in ceilings.

## 1.7 FIELD QUALITY CONTROL

- A. Testing: By Contractor-engaged agency or Contractor.

**END OF SECTION**

**SECTION 28 23 00****VIDEO SURVEILLANCE SYSTEM****PART 1 - GENERAL****1.01 SUMMARY**

- A. General: 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 analog and IP fixed and PTZ cameras, lens, mounts, and housings
  - 3. CCTV power supplies
  - 4. Network video storage servers
  - 5. Integration with ACAMS
  - 6. 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. Ethernet cable back to IDF/MDF room for IP cameras
  - 3. Owner provided PoE switches in the IDF/MDF for CCTV connectivity via security LAN/WAN
  - 4. Network ports for video storage servers, IP video encoders, and video monitoring workstation connectivity via security LAN/WAN
- 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 13 00 Access Control & Alarm Monitoring System: includes product information for video integration with the ACAMS.
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 Commissioning: includes the integrating testing/commissioning requirements for 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. The Definitions of Division 1 apply to the 28 00 xx sections.
- B. In addition to those Definitions of Division 1, the following list of terms as used in this specification defined as follows:
  1. "NVR": Network Video Recorder
  2. "VMS": Video Management System
  3. "PTZ": Pan-Tilt-Zoom
  4. "NAS": Network Attached Storage
  5. "PoE": Power-over-Ethernet

## 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 consists of IP-based fixed position and pan-tilt-zoom (PTZ) cameras connected to centralized IP video encoders that encode and stream video over the network.
  2. Assess the existing NVR servers to determine additional camera capacity and storage. Notify the Owner when an additional server is required. Provide Network Video Recorder (NVR) server software on rack mount server located on existing MPOE security rack to allow for incremental

- growth of up to 64 more network cameras and storage space for at least 30 days for video retention.
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 video servers, additional video monitoring workstations, and IP cameras with the District's IT department prior to installation. Provide one security network connection for each device.
  5. Provide fixed 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. Provide fixed 180 degree megapixel cameras at locations as shown on the project drawings for maximum surveillance. Coordinate site lighting when locating 180 degree cameras outside.
  7. Utilize PoE switches for camera power and connection to VMS. Fixed cameras home run on low voltage power and coaxial video cable. Connect to the servers and new 24VAC CCTV power supplies.
  8. Provide PTZ CCTV cameras as indicated on the floor plans. Include environmental housing with heater and blower for cameras located outdoors. PTZ camera power home runs on low voltage cable back to power supplies located in MDF/IDF rooms.
  9. Home run and connect exterior weather proof camera video signal and data control cable to video servers. Power cameras locally from CCTV power supplies located within 50 feet. Size power supplies accordingly for voltage loss and power demands for outdoor rated enclosures with heater and blower options included.
  10. Provide CCTV camera power supplies located in the IDF rooms adjacent to ACAMS power supplies.
  11. Provide day/night cameras in outdoor locations with low light levels.
  12. 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.
  13. Provide LAN and Power-Over-Ethernet extender for IDF to camera distances greater than 270 feet. Refer to Section 280513 Security System Cabling for device information.
  14. Provide IP video encoders with 4 analog video inputs each and a network port. Locate in IDF rooms wall mounted adjacent to ACAMS equipment panels. Coordinate any rack mount video server locations with the District's ITS department prior to installation.
  15. 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. Program PTZ cameras to view preset locations upon alarm events. Review each preset location with the District and System Operators in the programming meeting.
- c. Setup video encoder built-in video motion detection when ACAMS alarms are not available. Review each location with the District during the programming meeting.
- d. 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. Custom Device Requirements

1. Provide fiber optic media encoders and decoders for analog and IP camera locations over 1200 feet from an IDF closet. Coordinate fiber optic cable infrastructure and allocation for security functions with ITS and telecommunications engineers.

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

#### 1.04 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
  - 1. 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
  - 2. Cameras and support devices
    - a. 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 NETWORK VIDEO RECORDERS

- A. Features
  - 1. Complete Network Video Recorder platform that encompasses recording video, viewing video, reviewing recorded video, and storing video for indefinite periods of time.
  - 2. Full control of camera selections, sequencing, and viewing modes

3. The system simultaneously records, displays live video, and plays back video. None of the video operations interfere with each other. Live view and video playback does not interrupt the recording process.
4. Recorders capture, digitize, and store video. Recorders may record full-time, in response to an alarm, or based on a user-defined schedule. Full-time recording refers to 24 hours per day, 7 days per week, 365 days per year.
5. Network: Internal Ethernet card for connection to a 100/1000Base-T LAN.
6. Video Capture: Captures camera signals from fixed cameras, PTZ cameras, low light cameras, and edge video servers. Camera signals may be color, black and white, or both.

#### B. Recorders

1. Use TCP/IP network protocol to communicate with network cameras and other video servers.
2. Video Information
  - a. Store the time, date, and source of the video and be available during playback.
  - b. Store for each clip video source, capture date, start time, and stop time. Source identified as either a monitor or a camera.
  - c. Store alarm information in the database on the main server when the video is in response to an alarm condition.
3. Recording Configuration
  - a. Use TCP/IP network protocol to communicate to field devices and client workstations.
  - b. Captures camera signals from fixed cameras, PTZ cameras, infrared cameras, x-ray cameras, and low light cameras. Camera signals may be color, black and white, or both.
  - c. Capable of simultaneously recording each camera at VGA (640x480) resolution at 30 frames per second NTSC and 1.3 megapixel (1280x1024) or higher resolution at least 12 frames per second.
  - d. Support for multi-megapixel cameras, MPEG-4 and H.264 compression, and future video analytics.
4. Video Storage
  - a. Video stored in clips on the recorder's internal hard drive. As the hard drive becomes full, groom oldest clips to make room for new video.
  - b. Ability to utilize a variety of network storage devices such as external disk arrays, RAID and NAS devices, and external disk drives for exporting, backup, or sharing images.
  - c. Ability to modify video quality per camera with respect to recorder and server configurations, length of time video to be store.
5. Video Authentication
  - a. Fingerprint each video clip through a mathematical algorithm during the video capture process. The fingerprint becomes part of the clip and used by the playback software to verify the video has not been altered.
6. Alarm recording

- a. Recording Options
  - 1) Alarm condition via activation of an external alarm contact.
  - 2) Internal video motion detection
- b. Recording programmable by camera and by time and date schedule.
- c. Allow a mix and match of continuous recording and alarm recording, based on camera input and capture card connection.
- d. Pre and post alarm recording
7. Video Motion Detection
  - a. Support cameras capable of detecting activity from camera input and to initiate an alarm condition.
  - b. Video motion detection areas operator selectable for each camera. If the scene changes within the alarm area, an alarm condition is initiated.
8. Viewing of both live and archived images, from multiple remote systems.
9. Remote event notification
10. Unlimited number of clients
11. Password protected via user authorization, with profiles assigned by the system administrator, and database tracking of events.
- c. NVR Hardware (verify hardware meets software requirements at time of purchase)
  1. Complete prepackaged unit containing:
    - a. Processor: Intel Xeon E5520 8MB Cache, 2.26GHz, 1066MHz FSB
    - b. Memory: 4GB 1066MHz (2x2GB), Dual Ranked DIMMs
    - c. Hard Drive: Minimum of (4) four 750GB 7.2K RPM, SATA 3bps hard drives
    - d. Provide 12TB of storage
      - 1) Create 40GB Microsoft OS partition override for primary hard drive
      - 2) Provide 300GB segment for video management software use.
    - e. OS: Windows Server 2003, Standard Edition SP2 with 5 CALs
    - f. 24x IDE CD-RW/DVD ROM drive
    - g. Network Adapter: Dual embedded gigabit Ethernet NIC
    - h. Video Card: Integrated
    - i. Chassis Configuration: Rack chassis for up to six 3.5-inch hard drives with sliding rails and cable management arm,
  2. Manufacturer:
    - a. Dell PowerEdge R710
    - b. Or Equal
- D. NVR Software
  1. Manufacturer:
    - a. exacq Technologies: exacqVision VMS Software. Verify quantity of IP cameras supported with hardware configuration at time of purchase.
    - b. exacqVision Camera License #EVIP-01
    - c. exacqVision Software Update Subscription #SSA-EVIP-01

## 2.03 SECURITY WORKSTATION

- A. System Hardware: Document the cost of this hardware at time of bid due to price reductions and advancements in technology. Prior to placement of order, provide upgrades to the most current model as requested by the Owner up to the cost of the specified system.
1. Processor: Intel Core i7 860 8MB Cache, 2.80GHz, 1333MHz FSB
  2. Random Access Memory: 4GB minimum.
  3. Mass Storage: 320 GB (7,200 RPM, 8 ms avg. seek) fixed disk drive.
  4. Video Card: (2) 512MB PCI express graphics card with (2) DVI outputs each supporting up to four monitors
  5. I/O Ports
    - a. Mouse port
    - b. 1-parallel port
    - c. 2-RS232 serial ports
    - d. 4-USB 2.0 ports
    - e. One 10/100/1000 BASE-TX NIC
  6. Input media
    - a. 1.44 MB 3.5" diskette drive
    - b. 48x CD/DVD-R/W drive
  7. Keyboard: Enhanced 101-key with tactical feedback.
  8. Mouse: Logitech 3-button mouse.
  9. 20" Flat Panel LCD Monitor (two per workstation)
    - a. Screen Dimension: 20 in (viewable image size)
    - b. Minimum Resolution: 1600x1200 / 60Hz
    - c. Image Brightness: 300cd/m<sup>2</sup>
    - d. Image Contrast Ratio: 800:1
- B. Software
1. Operating System: Most current version of Windows supported by the system manufacturer
  2. Provide exacqVision Video Management Software on client workstations used for video surveillance:
    - a. This application shall be installed on any Windows-based computer with a network connection to the digital video management system(s) for live and recently recorded video.
    - b. The client workstation viewer interface shall allow the user to simultaneously view recorded video from multiple cameras and multiple digital video management systems.
    - c. Multiple workstations can access the digital video management system simultaneously.
    - d. Cameras are viewed in a video window by dragging an icon to the window. Camera combinations are automatically saved for each video window configuration.
    - e. The camera name and time of video capture can be displayed using a menu option. Text position and color shall be user-configurable.

- f. Cameras shall be organized in a directory tree by their name and grouped together under specific categories. The digital video management system to which they are connected should not interfere with the organization or user interface.
- g. A search utility is necessary in the management software. Recorded video shall be searchable based on alarm, date, time, and camera.
- 3. exacq Technologies Software: exacqVision Client Software (most current version)
- c. UPS:
  - 1. Provide one UPS for each workstation furnished.

## 2.04 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 Interior Dome Cameras
  - 1. Complete prepackaged unit containing:
    - a. Superior 640x480 resolution to 1.3 megapixel, or higher, image sensor quality with progressive scan
    - b. Resolution: 30 frames per second at 1280x1024 and 30 frames per second at 640x480
    - c. Video streaming: Simultaneous Motion JPEG, MPEG-4, and H.264
    - d. Auto iris, varifocal lens of 2.8-10mm, 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. Dome housing
  - 2. Manufacturer:
    - a. AXIS #P3301-V network interior dome camera
    - b. AXIS #P3304-V network interior dome megapixel camera



- c. Arecont Vision #AV1305 megapixel camera
- d. Arecont Vision #AV2105 2 megapixel camera
- e. Or Owner Approved Equal
- 3. Accessories:
  - a. AXIS Drop Ceiling mount kit #5005041
  - b. Arecont Vision #Dome 5-I interior recessed dome
  - c. Or Owner Approved Equal
- c. Fixed IP Exterior Megapixel Dome Cameras
  - 1. Unit containing:
    - a. Superior 1.3 megapixel image sensor, or higher quality with progressive scan
    - b. Resolution: 30 frames per second minimum at 1280x1024 and 30 frames per second at 640x480
    - c. Video streaming: Simultaneous Motion JPEG, MPEG-4, and H.264
    - d. Auto iris, varifocal lens of 2.8-10mm, 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. AXIS #P3344-VE fixed network camera
    - b. Arecont Vision #AV1355DN-16HK fixed dome camera with
    - c. Or Owner Approved Equal
  - 3. Accessories:
    - a. AXIS mounting plate #5502-401, or pendant kit #5502-351
    - b. Arecont Vision mounting plate #MD-EBA, or pendant kit #MD-CMT
    - c. Or Owner Approved Equal
- D. IP 180 Degree Panoramic Camera
  - 1. Complete dome unit containing:
    - a. Four 2 megapixel cameras for 8 megapixel total
    - b. 180 degree field of view
    - c. Total Resolution 6400x1200 at 5.5 frames per second
    - d. Video streaming: simultaneous Motion JPEG and H.264
    - e. Power over Ethernet (IEEE 802.3af), Class 1
  - 2. Manufacturer:
    - a. Arecont Vision #AV8185
  - 3. Accessories:
    - a. Arecont Vision #6-I-C, 6-I-W, 6-O-C, 6-O-W mounts or recessed kit #RD-KIT

- E. PTZ IP Dome Camera
1. Provide IP PTZ camera with appropriate mount
  2. Complete prepackaged unit containing:
    - a. 1/4" high-resolution color CCD camera & motorized zoom auto-iris lens
    - b. High-speed pan and tilt that is stepper motor driven (belt-driven not acceptable).
    - c. Integral receiver/driver
    - d. Color NTSC format
    - e. Integral 35X min optical zoom lens for exterior locations, 18x min optical zoom for interior locations
    - f. Exterior cameras: wide dynamic range and auto day/night switching between color and B/W
    - g. Motion JPEG and H.263 video compression
    - h. Integrated heater and blower for exterior locations
    - i. Electronic Image Stabilizer
    - j. Guard tour with 50 presets minimum
  3. Provide seismic support of unit attached directly to second floor deck. T-Bar hangers are acceptable provided they are dedicated to support PTZ.
  4. Manufacturer:
    - a. Interior – AXIS 232D+
    - b. Exterior – AXIS Q6032-E
    - c. HD PTZ – AXIS/Sony
  5. Accessories:
    - a. AXIS Pendant Brackets: wall #5017-611, corner #5017-641, pole #5017-671
- F. Fixed Analog Camera
1. Provide ceiling flush mounted integrated dome/camera/lens packages.
  2. Camera must provide 480 Lines of resolution minimum.
  3. Minimum Illumination level of 2.4 Lux (0.24 fc) for indoor, 0.16 Lux (0.016 fc) for outdoor B/W
  4. Provide integral variable focus lens (3.8-8.0 mm) for field adjustments as required
  5. Lens equipped with auto iris
  6. Vandal proof enclosure
  7. Exterior cameras: wide dynamic range and automatic day/night switching between color and B/W
  8. Manufacturer:
    - a. Interior Dome: Panasonic WV-CW224 Series
    - b. Exterior Dome: WV-CW484 Series w/ WV-CW4H Heater Unit
- G. Pan/Tilt/Zoom Dome
1. Provide PTZ with appropriate mount
  2. Complete prepackaged unit containing:
    - a. 1/4" high-resolution color CCD camera & motorized zoom auto-iris lens

- b. High-speed pan and tilt that is stepper motor driven (belt-driven not acceptable).
- c. Integral receiver/driver
- d. Color NTSC format
- e. Integral 22X min optical zoom lens
- f. Internal AC Line lock for auto syncing
- g. Exterior cameras: wide dynamic range and auto day/night switching between color and B/W
- h. Integrated heater and blower for exterior locations
- 3. Connect PTZ data directly to video server for on screen PTZ control.
- 4. Provide seismic support of unit attached directly to second floor deck. T-Bar hangers are acceptable provided they are dedicated to support PTZ.
- 5. Manufacturer:
  - a. Pelco Spectra IV SE Series Dome

## 2.05 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. Manufacturer:
    - 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

## 2.06 CAMERA MOUNTS & 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
- C. Parapet
1. Mount: Pelco #PP350 / PP351
  2. Mount: AXIS #25738
  3. Housing: Integrated heater and blower

## 2.07 IP VIDEO ENCODER

- A. General
1. Video Compression: Motion JPEG, MPEG-4 Part 2 (ISO/IEC 14496-3), Profiles: ASP and SP
  2. Resolution: 4CIF, 2CIFExp, 2CIF, QCI
  3. Frame Rate: Up to 30/25 per channel
  4. Pan/Tilt /Zoom control
  5. Alarm and event management
- B. Standalone Video Server
1. Wall-mount single unit
  2. Channels: 1 or 4
  3. Security: IP address filtering and HTTPS encryption
  4. Manufacturer:
    - a. Axis #Q7401 1-port encoder
    - b. Axis #Q7404 4-port encoder

## 2.08 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
- B. Video Server Power Supplies
1. 120V hardwired input.
  2. 6 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 AL600ULX

## 2.09 CCTV FIBER CONVERTERS

- A. Wall Mounted
  1. Transmit full color video in real time in NTSC, PAL or SECAM formats.
  2. Support the transmission RS-232 and RS-422 data.
  3. Utilize AGC (automatic gain control) circuitry.
  4. No in-field electrical or optical adjustments or in-line attenuators.
  5. Use frequency modulation of the optical signal to transmit the video and data signals.
  6. If video and data transmitted simultaneously on one fiber, utilize an integrated WDM for increased stability and reliability of system performance.
  7. Provide power, data transmit, video input, and AGC (automatic gain control) detect status indicating LED's for monitoring proper system operation.
- B. Manufacturer:
  - a. Fiber Options
  - b. International Fiber Systems
  - c. Pelco Fiber
  - d. Or Equal

## 2.10 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. Video Line Coaxial Cable Protectors
  1. Provide on coaxial cables serving exterior cameras.
  2. Manufacturer:
    - a. PolyPhaser Corp #IS-75BB/1.5
    - b. DITEK
    - c. Or Equal
- C. Power Line Protectors
  1. Provide on power lines serving exterior cameras.
  2. Manufacturer:
    - a. PolyPhaser Corp #IS-SPTV

- b. DITEK
  - c. Or Equal
- D. PTZ Data Line Protectors
- 1. Provide on data lines serving exterior PTZ cameras.
  - 2. Manufacturer:
    - a. PolyPhaser Corp #IS-DPHSD
    - 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 Data Drop 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 Site Cameras
- 1. Installation requirements under paragraph A, CCTV Cameras still apply.
  - 2. Provide NEMA 4 enclosure located in close proximity to the camera(s) with 120VAC power.
    - a. Install near base of pole for pole-mounted locations.
    - b. Install in nearby accessible ceiling below for roof mount cameras.
  - 3. Route camera cable to NEMA box and terminate.
  - 4. Provide waterproofing material and required gaskets in order to maintain roofing system warranty. Verify installation does not void roofing warranty.
  - 5. Provide lightning protection on cameras located on 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. Network Digital Recording System
  1. Rack mount NVRs next to existing units on dedicated security rack.
  2. Coordinate equipment rack location with District IT department.
- F. IP Video Encoder
  1. Wall mount near ACAMS security equipment hub in NEMA enclosure.
  2. Utilize power from ACAMS controller for video servers whenever possible.
  3. Coordinate Network Data Drop with Telecom contractor for each video server.
  4. Coordinate IP address with District IT staff.
- G. 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. Commission the video surveillance system in accordance with Section 28 08 00.

END OF SECTION



**- SECTION 28 31 00 -****FIRE DETECTION AND ALARM SYSTEM**

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**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 describes a Protected Premises Fire Detection system for the following San Mateo County Community College District sites: Cañada College, College of San Mateo and Skyline College. [The new fire alarm system] [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.

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, provided 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:

1. Fire Alarm Control Panel (FACP)
2. Fire Alarm Remote Annunciator (FAAP), as indicated on the drawings
3. Booster Power Supplies, as required, for notification devices
4. Addressable Manual Fire Alarm Pull Stations
5. Addressable Analog Smoke Detectors
6. Addressable Area Heat Detectors
7. Addressable Analog Duct Smoke Detectors
8. Addressable Intelligent Interface Modules
9. Audible and Visual Notification Appliances

- B. 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:
  - 1. Sprinkler Water Flow Alarm (alarm initiating)
  - 2. Sprinkler Valve Tamper Switch (supervisory)
  - 3. PIV, OS&Y
  - 4. Kitchen Ansul Systems
  - 5. Security Interface
  - 6. Magnetic hold-opens
  
- C. Connections to existing elevator control panels (by others) and providing the necessary modules for elevator recall and shunt trip functionality.
  
- D. Audible/visual notification appliances and communicating devices to be controlled by the FACP:
  - 1. Horns
  - 2. Strobe Lights
  - 3. Combination Horn/Strobes
  - 4. Bells
  
- E. Connect system to the existing campus MXL network system such that all status changes are transmitted to the Main Campus FACP.
  
- F. 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.

### **1.3 RELATED SECTIONS, RELATED WORK AND EXISTING CONDITIONS**

- A. RELATED SECTIONS
  - 1. Section 21 00 00 Basic Fire Protection
  - 2. Section 01 32 19 Submittal Procedures
  - 3. Division 01 General Requirements

### **1.4 RELATED WORK**

- A. 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.

- a. 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.
- b. Security Interface, if required.
- c. Coordinate with all other trade contractors for the mounting of and/or interfacing with any and all other fire alarm system related devices.

## 1.5 EXISTING CONDITIONS

- A. This project consists of [providing a new fire alarm system within the new building] [replacing the existing fire alarm system within the existing building] [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.
- B. No additional compensation shall be permitted for variations due to accessible field conditions that would affect the installation of the fire alarm system.

## 1.6 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.

## 1.7 SYSTEM DESCRIPTION

- A. The system shall operate as an integrated, multiplexed, protected premises fire alarm control system tied into the existing campus network system.
- B. 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 [peer-to-peer (College of San Mateo and Skyline College)] [master-slave (Cañada College)] networking protocol.
- C. Sensor "dirty" and "excessively dirty" trouble conditions shall report automatically.
- D. 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.
- E. 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.
- F. System shall individually identify each addressable initiating device and other addressable monitor functions using multiplexing interfacing techniques.
- G. System shall be capable of operating each alarm notification appliance, and other control functions, using multiplexing techniques.
- H. 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.

## 1.8 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 Instructions to Bidders, 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 Instructions to Bidders, shall be considered by the engineer. Failure to submit all departures from these specifications in compliance with Document 00 11 19 Instructions to Bidders, 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.

## 1.9 SUBMITTAL REQUIREMENTS

- 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% 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% 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.

## **PART 2 - SYSTEM OPERATION**

### **2.1 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% 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% 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."

## 2.2 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.

## 2.3 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
    - a. Indicate "SUPERVISORY" status change at the respective building Remote Annunciator indicating device address, device type, device location, time and date
    - b. Activate General "SUPERVISORY" status change at the Off-Site Monitoring Station, through the Campus Network System.
    - c. Annunciate "SUPERVISORY" status change at the On-site Main Campus Fire Alarm Control Panel location.
    - d. Record event in the non-volatile system historical log.

- e. Record event system status change on the Main Campus Printer location.

**B. SYSTEM TROUBLE FUNCTIONS**

1. Receipt of a system trouble alarm, shall cause the following actions and indications:
  - a. Activate "TROUBLE" status change at the FACP and annunciate on its LCD display, indicating device address, device type, device location, time and date
  - b. Indicate "TROUBLE" status change at the respective building Remote Annunciator indicating device address, device type, device location, time and date.
  - c. Activate General "TROUBLE" status change at the Off-Site Monitoring Station, through the Campus Network System.
  - d. Annunciate "TROUBLE" status change at the On-site Main Campus Fire Alarm Control Panel location.
  - e. Record event in the non-volatile system historical log.
  - f. Record event system status change on the Main Campus Printer location.
  
1. The fire alarm system wiring shall be electrically supervised to automatically detect and report trouble conditions to the FACP.
  
2. 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.
  
3. The FACP shall initiate a system trouble condition when the following occurs:
  - a. Primary 120/220 VAC power loss.
  - b. Battery disconnect.
  - c. Battery low voltage.
  - d. LCD annunciator panel power loss.
  
5. 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.
  
6. 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.
  
7. Removal of or failure of internal electronic circuitry of any addressable device shall initiate a system trouble condition.

**2.4 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. 2. 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.

## 2.5 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.

**2.6 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. 2. 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 based on the fire alarm manufactures 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.

**2.7 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.

Initiating Devices		Communication Devices	
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 - TESTING AND ACCEPTANCE**

### **3.1 FIELD QUALITY CONTROL**

#### **A. CERTIFICATE OF COMPLIANCE**

1. 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.

#### D. DOCUMENTATION

1. System documentation shall be furnished to the owner and shall include but not be limited to the following:
  - a. 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.
  - b. System operation, installation and maintenance manuals.
  - c. Written documentation for all logic modules as programmed for system operation with a matrix showing interaction of all input signals with output commands.
  - d. System program "hard copy" showing system functions, controls and labeling of equipment and devices.
  - e. All specified documentation as required under sections (2.01.E. and 3.01.C.).

E. CLEANING

1. Contractor shall thoroughly clean all areas in which it works at the end of each work day and upon completion of installation.

F. WARRANTY/SERVICES

2. 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.

G. TRAINING

1. The fire alarm contractor shall furnish training as follows for a minimum of four employees of the system user:
  - a. Training in the receipt, handling and acknowledgment of alarms.
  - b. Training on system operation including manual control of output functions from the FACP.
  - c. The total training requirement shall be a minimum of 4 hours, but shall be sufficient to cover all items specified.

**END OF SECTION**

## **- SECTION 28 3111 -**

# **DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM**

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## **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. System Description: Noncoded, UL-certified addressable system with automatic sensitivity control of certain smoke detectors; multiplexed signal transmission, dedicated to fire-alarm service only.
- B. Siemens MDX, to match the Campus standard.

### **1.3 QUALITY ASSURANCE**

- A. Quality Standard: NFPA 72.
- B. Installer Qualifications: Certified by NICET .

### **1.4 SYSTEMS OPERATIONAL DESCRIPTION**

- A. Signal initiation from:
  - 1. Manual stations.
  - 2. Heat detectors.
  - 3. Flame detectors.
  - 4. Smoke detectors.
  - 5. Duct smoke detectors.
  - 6. Verified automatic alarm operation of smoke detectors.
  - 7. Automatic sprinkler system water flow.
  - 8. Heat detectors in elevator shaft and pit.
  - 9. Fire-extinguishing system operation.
  - 10. Fire standpipe system water flow.
- B. Signal initiates the following actions:
  - 1. Continuously operate alarm notification appliances.
  - 2. Identify alarm at the fire-alarm control unit and remote annunciators.

3. Transmit an alarm signal to the remote alarm receiving station.
  4. Unlock electric door locks in designated egress paths.
  5. Release fire and smoke doors held open by magnetic door holders.
  6. Activate voice/alarm communication system.
  7. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
  8. Activate smoke-control system (smoke management) at firefighter smoke-control system panel.
  9. Activate stairwell and elevator shaft pressurization systems.
  10. Close smoke dampers in air ducts of designated air conditioning duct systems.
  11. Recall elevators to recall floors.
  12. Activate emergency lighting control.
  13. Activate emergency shutoffs for gas and fuel supplies.
  14. Record events in the system memory.
  15. Record events by the system printer.
- C. Supervisory signal initiation by:
1. Valve supervisory switch.
  2. Elevator shunt-trip supervision.
- D. Trouble signal initiation by:
1. Open circuits, shorts, and grounds, in designated circuits.
  2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
  3. Loss of primary power at fire-alarm control unit.
  4. Ground or a single break in fire-alarm control unit internal circuits.
  5. Abnormal ac voltage at the fire-alarm control unit.
  6. Break in standby battery circuitry.
  7. Failure of battery charging.
  8. Abnormal position of any switch at the fire-alarm control unit or annunciator.
  9. Fire-pump power failure, including a dead-phase or phase-reversal condition.
  10. Low-air-pressure switch operation on a dry-pipe or preaction sprinkler system.
- E. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators. Record the event on system printer.

## 1.5 PRODUCTS

- A. Fire-Alarm Control Unit: Modular, power-limited design with electronic modules, addressable initiation devices.
1. Alphanumeric liquid-crystal display with 3 line(s) of 80 characters and system controls and keypad.
  2. Retain one of two subparagraphs below.
  3. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class A.
    - a. Initiating Device Circuits: Style D.
    - b. Notification Appliance Circuits: Style Z.

- c. Signaling Line Circuits: Style 6.
    - 4. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class B.
      - a. Initiating Device Circuits: Style A.
      - b. Notification Appliance Circuits: Style W.
      - c. Signaling Line Circuits: Style 4.
  - B. Manual Fire-Alarm Boxes: Single action.
  - C. System Smoke Detectors: Base mounted, self-restoring, with integral visual-indicating light and remote controllability from fire-alarm control unit.
  - D. Nonsystem Smoke Detectors: Single-station duct smoke detectors.
  - E. Heat Detectors: Combination type.
  - F. Notification Appliances:
    - 1. Chimes: High-level output.
    - 2. Horns: Electric-vibrating-polarized type, 24-V dc.
    - 3. Visual Alarm Devices: Xenon strobe lights.
    - 4. Voice/Tone Speakers: Flush mounted.
  - G. Firefighters' Telephones: Dedicated, two-way, supervised, telephone voice communication links between fire-alarm control unit, the fire command center, and remote firefighters' telephone stations.
  - H. Magnetic Door Holders: Wall- or floor-mounted units; 24-V ac or dc.
  - I. Remote Annunciator: Alphanumeric display same as fire-alarm control unit.
  - J. Addressable Interface Device: Microelectronic monitor module with integral relay to initiate elevator recall.
  - K. Digital Alarm Communicator Transmitter: For transmission of fire-alarm, supervisory, and trouble signals to a remote alarm receiving station or another remote location by means of telephone lines.
  - L. Radio Alarm Transmitter: For transmission of fire-alarm, supervisory, and trouble signals to a remote alarm receiving station or another remote location by means of radio signal.
- 1.6 FIELD QUALITY CONTROL**
- A. Testing: By Contractor.

## **END OF SECTION**



## DIVISION 31 – EARTHWORK

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**- SECTION 31 0000 -****EARTHWORK AND GRADING**

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**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.
- B. Geotechnical Report:
  - 1. A geotechnical report is available and is titled "Geotechnical Investigation and Geologic Hazards Evaluation, College of San Mateo, Building 5N Modernization, 1700 W. Hillsdale Boulevard, San Mateo, California" prepared by Cornerstone Earth Group, dated February 1, 2008.

**1.2 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 San Mateo, 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 1000 – Site Preparation.
  2. Section 31 2333 – Trenching, Backfilling, and Compacting.

### 1.3 DEFINITIONS

- A. Engineered Fill:
1. Soil or soil-rock material approved by Project Manager 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.
- 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.
- H. Subgrade: The uppermost surface of an excavation or the top surface of a fill or backfill immediately below top soil, rock base course, or drainage fill.

### 1.4 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.
  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 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 Section 93106 and Section 93105 of California Code of Regulations, Title 17.

## 1.5 SUBMITTALS

- A. Comply with provisions of Section 01 3219 – 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. Permit/Notice of Intent (N.O.I.), for discharge of storm run-off from the construction site.

4. Soil Sterilant.
  5. Termiticide.
- C. Shoring Design: Submit 4 copies of shoring design and shop plans; none will be returned unless a concern is observed.
- D. Submit description of vibratory compactors proposed for use when requesting placement of backfill and fill materials in layers greater than 6 inches thick.

## 1.6 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).
  4. San Mateo Department of Public Works, Standards and Specifications and Plans.
- 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 01 4523 – 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:
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.

### 1.7 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 01 5100 – Temporary Facilities and Controls where necessary to control dust and noise on and near the work caused by operations during performance of the Work.

### 1.8 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 01 5100 – 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.
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.

## 1.9 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.

### **1.10 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, designate 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 less than 5 nor 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.
- C. Topsoil: 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. Provide 2-inch layer under building slabs on grade.
  - 2. Provide layer at least two feet wide (thick) against embedded walls.
  - 3. Provide at other locations indicated.
  - 4. 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. Backfill material for use behind retaining walls shall be a granular material consisting of sand, broken rock, or a mixture of sand and gravel containing no size larger than 2 ½ inches and not more than 15 percent passing the No. 200 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 ½ 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 12, 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.
  
- I. Pea Gravel: 3/8 inch to ½ inch washed, uncrushed gravel. Use at drainage pipe and at other locations indicated.
  
- J. 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.

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- K. 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.
- L. 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.

# 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 31 1000 – 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 basement depth.
  1. Review the necessity for overexcavation of expansive soils.
- B. Scarify building pad, exterior flatwork and pavement subgrade to a depth of at least 8 inches and work until uniform and free from large clods.
  1. Bring expansive subgrades to 2 to 5 percentage points above the optimum moisture content and compact 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 12 - 18 inches of pavement subgrades to 95 percent of the maximum laboratory dry density per ASTM D1557 for nonexpansive subgrades.

### 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 subject to testing 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 2333 – Trenching, Backfilling, and 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 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, and free from irregular surface drainage.

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 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.
- 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 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.

### **3.12 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.

### **3.13 CLEAN-UP**

- A. Comply with requirements of Section 01 7400 - Cleaning.

**- END OF SECTION -**





## - SECTION 31 1000 -

# SITE PREPARATION

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### **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.
- B. Geotechnical Report:
  - 1. A geotechnical report is available and is titled "Geotechnical Investigation and Geologic Hazards Evaluation, College of San Mateo, Building 5N Modernization, 1700 W. Hillsdale Boulevard, San Mateo, California" prepared by Cornerstone Earth Group, dated February 1, 2008.

#### **1.2 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 0000- Earthwork and Grading.
  - 2. Section 31 2333- Trenching, Backfilling, and Compacting.

**1.3 SUBMITTALS**

- A. Comply with requirements of Section 01 3219 – Submittal Procedures.

**1.4 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.

**1.5 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.

**SITE PREPARATION**

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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 0000 – 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 SECTION -**

**- SECTION 31 2333 -****TRENCHING, BACKFILLING, AND COMPACTING**

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**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.
- B. Geotechnical Report:
  - 1. A geotechnical report is available and is titled "Geotechnical Investigation and Geologic Hazards Evaluation, College of San Mateo, Building 5N Modernization, 1700 W. Hillsdale Boulevard, San Mateo, California" prepared by Cornerstone Earth Group, dated February 1, 2008.

**1.2 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:
  - 1. Section 31 0000 – Earthwork and Grading
  - 2. Section 31 1000 – Site Preparation
  - 3. Section 33 1000 – Water Systems
  - 4. Section 33 3000 – Sanitary Sewer
  - 5. Section 33 4000 – Storm Drainage

**1.3 DEFINITIONS**

- A. Engineered Fill:
  - 1. Soil or soil-rock material approved by the Project Manager 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.
- 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.

#### 1.4 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.

#### 1.5 SUBMITTALS

- A. Comply with provisions of Section 01 3219 – Submittal Procedures.

#### 1.6 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.

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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.

## 1.7 DELIVERY, STORAGE AND HANDLING

- A. Protect materials before, during and after installation.
- B. Comply with provisions of Section 01 5100 – Temporary Facilities and Controls where necessary to control dust and noise on and near the work caused by operations during construction activities.

## 1.8 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 5100 – 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.
  1. Coordinate with the Project Manager.
  2. Any additional fill requirements shall be the responsibility of the Contractor.

## 1.9 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.

**1.10 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.

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- a. Red: Electric.
  - b. Yellow: Gas, Oil; Dangerous Materials.
  - c. Orange: Telephone and Other Communications.
  - d. Blue: Water Systems.
  - e. Green: Sewer Systems.
  - f. White: Steam Systems.
  - g. 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.
- 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.
  - 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.
- 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 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.
- E. Backfill trenches resulting from utility removal in lifts of 8 inches maximum.

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**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 at 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 foundation, trench bottom shall be stabilized with gravel or crushed rock. The State's inspector 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 non-expansive native material 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 2-1/2 feet of finished permanent surface grade or 1-1/2 feet below the finished subgrade, whichever is greater.

C. Jetting and Ponding:

1. Jetting of trench backfill is not permitted.

D. Compaction Testing:

1. Compaction testing shall be in accordance with California Test Method ASTM D1556 or D1557.

### 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 85 percent of the maximum laboratory dry density, per ASTM D1557.
  - 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.
  - 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.

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### TRENCHING, BACKFILLING, AND COMPACTING

- 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 SECTION -**





## **- SECTION 31 6800 -**

# **FOUNDATION ANCHORS**

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## **PART 1 - GENERAL**

### **1.1 RELATED INFORMATION AND REQUIREMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, specific Specification Sections listed below, and all other Specification Sections apply to this Section.
  - 1. Concrete Forming
  - 2. Concrete Reinforcing
  - 3. Cast-In-Place Concrete.

### **1.2 SECTION INCLUDES**

- A. All material, labor, equipment, and services necessary for the design, drilling, furnishing, installing, stressing, grouting, and performance proof testing all permanent ground anchors, as shown and as specified. All permanent ground anchors shall have Double Corrosion Protection.

### **1.3 REFERENCE DOCUMENTS**

- A. Standards: Comply with the provisions of the documents listed below and with the requirements described in this Section. Use current editions of documents unless earlier editions are specifically referenced by the governing code or are otherwise indicated.
  - 1. CBC – 2007 California Building Code.
  - 2. ACI, American Concrete Institute, 301 “Specifications for Structural Concrete for Buildings.”
  - 3. ACI, American Concrete Institute, 318 “Building Code Requirements for Structural Concrete.”
  - 4. ASTM, American Society for Testing and Materials
  - 5. PTI, Post-Tensioning Institute: Post-Tensioning Manual, latest edition, “Guide Specification for Post-Tensioning Materials and Rock and Soil Anchors.”
  - 6. FHWA, Federal Highway Administration, Publication No. FHWA-IF-99-015, “Geotechnical Engineering Circular No. 4-Ground Anchors and Anchored Systems”.
  - 7. ASTM, American Society for Testing and Materials, designations referenced herein.

B. Investigations:

1. Geotechnical Report entitled "Geotechnical Investigation and Geologic Hazard Evaluation, College of San Mateo Building 5N Modernization" dated February 1, 2008 and a supplemental letter dated May 21, 2008 prepared by Cornerstone Earth Group.
2. The Contractor shall become familiar with the surface and soils conditions at the site, whether covered in the report or not, and thoroughly understand all recommendations associated with earthwork.
3. The information contained in the above list of investigations was obtained for design purposes only. The Contractor is responsible for any conclusions he may draw from these reports; shall he prefer not to assume such risk, he shall employ his own experts to analyze available information and/or make additional investigations upon which to base his conclusions, all at the Contractor's expense.

**1.4 SUBMITTALS**

A. General: Submittals shall be sent to the Architect, or District's Testing Agency, or both, as required herein for review prior to commencing the work. Review of submittals covers the general character of the details and to verify compliance with the performance requirements. Review does not cover checking of quantities, proportions or dimensions. Such review shall not relieve the Contractor from responsibility for executing the work in accordance with the Contract Documents.

B. Shop Drawings and Details: The Contractor shall submit complete working drawings and design calculations describing the ground anchor system including their arrangement in the members, designations, anchorage details, stressing data, and the following items:

1. Ground anchor layout.
2. Anchor number.
3. Anchor design load.
4. Anchor test load.
5. Final lock off load.
6. Bond length.
7. Unbonded length.
8. Stressing tail length.
9. Total length of tendon.
10. Anchor hole diameter.
11. Unbonded length corrosion protection system.
12. Bonded length corrosion protection system.
13. Anchorage corrosion protection system.
14. Level of each stage of grouting.
15. Outline pour and tensioning sequence for each pour.
16. Furnish details of reinforcement around stressing pockets and closures, where interference with threadbars may occur. Coordinate with reinforcing bar drawings.
17. Show required elongation of each threadbar at jacking pressures.
18. Furnish complete prestressing procedure to include the following:
  - a. Jacking force and jacking pressure.

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- b. Maximum temporary jacking force and jacking pressure.
  - c. Certified jack calibrations and method of identification. Non-calibrated jack and pump combination will not be permitted. Submit certificates of calibration from approved testing laboratory to District's Representative for all jacks used on project. Calibration of pressure gauge and/or load cells shall be performed within 45 days of the date when they are submitted for approval for the project.
  - d. Method of determining slack.
  - e. Method of determining anchor force, or force remaining in threadbars after anchor.
19. Furnish method of cutting off excess anchor, after anchorage.
  20. Provide method of grouting.
  21. Furnish manufacturer's written guarantee that threadbar material is of strength specified.
- C. Test Reports: The Contractor shall submit mill tests and manufacturer's ASTM certification in accordance with the requirements stated or referenced herein for threadbars, slanted centralizer assemblies, grout, anchor assemblies and couplers to the District's Testing Agency for review.
- D. Product Data: Submit complete product literature and specifications for each component of the system, subsystem and subassembly, including grout.
- E. Mix Design: Grout mix design and procedures for placing the grout.
- F. Proof of Experience: The contractor shall furnish evidence that they have been engaged in successful installation, supply and testing of earth anchors for at least 5 years and a minimum of 15 projects of a nature similar to the one in this contract.
- G. Certificates: Submit materials' compliance to District's Testing Agency.
- H. Substitutions or alternates must be accompanied by complete calculations and shop drawings prepared in a manner suitable for presentation; signed by a Structural Engineer registered in California and submitted to District for review and approval.
- I. Review of details and construction operations will not relieve the Contractor of his responsibility for completing the work successfully in accordance with these specifications.

## 1.5 TESTS AND INSPECTIONS

- A. Notification:
1. The Contractor shall notify the District's Testing Agency and the District's Geotechnical Engineer of work to be tested and inspected. Notification shall be sufficiently in advance to allow scheduling of tests and inspections, but not less than 24 hours.
  2. The Contractor shall immediately notify the Architect if the District's Testing Agency indicates that quality assurance tests and inspection requirements have not been met.
- B. All tests and inspections shall be performed by or observed by the District's Testing Agency or the District's Geotechnical Engineer. Contractor shall cooperate with the District's Testing Agency Inspectors and the District's Geotechnical Engineer to facilitate the execution of their duties:

1. District's Geotechnical Engineer shall provide continuous visual observation of the drilling operations to determine that the soils conditions are as described in the Geotechnical Investigation.
  2. District's Testing Agency Inspector's Qualifications and Duties:
    - a. Qualifications: Trained and experienced in performing the required tasks and be under the supervision of a registered professional engineer.
    - b. Inspect thread bars and reinforcing prior to placing of concrete.
    - c. Report immediately to District's Representative all deviations from work as specified and shown.
    - d. Verify tensioning records prepared by Contractor and monitor all tensioning.
    - e. Take random samples of thread bar and submit to District's Testing Agency for testing. Include with samples manufacturer's certification stating that samples are representative of thread bar furnished for the work.
    - f. Test thread bar for tensile strength and elongation at rupture. Two tests shall be made for each heat or lot number. Each size of thread bar to be shipped to site shall be assigned an individual lot number and tagged accordingly.
    - g. Keep stressing records submitted by Contractor. Submit records to District's Representative for approval prior to all cutting or capping of thread bar anchorage.
    - h. Verify that grouting has been executed properly.
- C. Contractor's Quality Control (CQC) Representative:
1. Contractor shall appoint a qualified person to be in charge at all prestressing and tendon grouting operations. This person shall not be a member of the stressing crew or under the jurisdiction of the stressing foreman.
  2. The CQC Representative's duties shall be as follows:
    - a. Check threadbar placement before and during pouring of concrete. Be present during pours and check for threadbars being moved out of position.
    - b. Mark threadbars prior to stressing.
    - c. Record elongation of threadbars until he receives approval from District's Testing Agency Inspector.
    - d. Do not allow cutting off of threadbars until he receives approval from District's Testing Agency Inspector.
    - e. Be present during threadbar grouting operations and verify that grouting is executed in accordance with the requirements referenced herein.
- D. Anchor Testing: Each anchor shall be tested. The maximum test load shall not exceed 80 percent of the guaranteed ultimate tensile strength (GUTS) of the thread bar. The first two anchors, and at least 5 percent of the remaining anchors, shall be performance tested. The remaining anchors shall be proof tested. Testing shall be in accordance with "Federal Highway Administration Publication No. FHWA-IF-99-015". The design load (P) is defined on the drawings; the alignment load (AL) is equal to five percent of the design load (P).
- E. Performance Testing:
1. Performance tests shall be made by cyclically and incrementally loading and unloading the anchor to a series of increasing load levels. The load levels shall be 0.25P, 0.50P, 0.75P, 1.00P, 1.25P and 1.60P, where the 1.60P load is the Performance Test Load. The load shall be decreased to AL after each cycle. At each cycle, the movement of the anchor shall be recorded at every 0.25P load increment. The movement shall be

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recorded to the nearest 0.001 inches with respect to an independent fixed reference point. The load shall be held at each increment just long enough to obtain the movement reading, but no longer than 1 minute. Except for the reading of the residual movement of the alignment load (AL), no movement readings need to be taken during unloading of the anchor. The Performance Test Load shall be held for 15 minutes. Total movements with respect to a fixed reference point shall be recorded at 1, 2, 3, 4, 5, 10 and 15 minutes. If the total movement between 1 minute and 15 minutes exceeds 0.04 inches, the test load shall be held for an additional 45 minutes. Total movements shall then be recorded at 20, 25, 30, 45 and 60 minutes (15 minutes plus 45 minutes). The load hold time shall start when the pump begins to load the anchor from the 1.25P increment load to the Performance Test Load. The magnitude of the lock-off load should not exceed 70 percent of the guaranteed ultimate strength of the anchor.

2. The anchor load shall be measured with a pressure gage calibrated with the jack and accurate enough to read 100 psi changes in pressure. The pump shall be capable of applying each load increment in less than 60 seconds. A calibrated mastergage shall be kept at the site to periodically check the test gage.
3. The anchor may be completely unloaded prior to lock-off, if circumstances warrant. Final stressing then does not require further movement readings.

F. Proof Testing:

1. Proof testing shall be performed by loading the anchor to the Proof Test Load and recording the maximum movement at the various load increments listed below. At each increment, the movement of the anchor shall be recorded to the nearest 0.001 inch with respect to an independent fixed reference point. The anchor load shall be measured with a pressure gage calibrated with the jack and accurate enough to read 100 psi changes in pressure. The pump shall be capable of applying each load increment in less than 60 seconds. The increments of load shall be: AL, 0.25P, 0.50P, 0.75P, 1.00P, 1.25P and 1.60P, where the 1.60P load is the Proof Test Load.
2. The Proof Test Load shall be held for 15 minutes. Total movements with respect to a fixed reference point shall be recorded at 1, 2, 3, 4, 5, 10 and 15 minutes. If the total movement between 1 minute and 15 minutes exceeds 0.04 inches, the test load shall be held for an additional 50 minutes. Total movements shall then be recorded at 20, 25, 30, 45 and 60 minutes. The load hold time shall start when the pump begins to load the anchor from the 1.25P load increment to the Proof Test Load. The proof test results should be compared to the performance test results. Any significant variation from the performance test results warrants making a performance test on the next anchor.

G. Lift-Off Readings:

1. After transferring the load to the stressing anchorage and prior to removing the jack, a lift-off reading shall be made. The load determined from the lift-off reading shall be within 5 percent of the specified lock-off load. If the load is not within 5 percent of the lock-off load, the end anchorage shall be reset and another lift-off reading shall be made.
2. Lift-off tests may be specified by the engineer. The stressing anchorages shall be capable of lift-off in order to check the anchor load. Allowances shall be made for time-dependent losses when comparing the lift-off with the previous lock-off reading.

H. Acceptable Criteria:

1. The District's Representative shall investigate the anchor test results and determine whether the anchor is acceptable. An anchor shall be acceptable if:

- a. The total elastic movement obtained from a performance test of the in-place anchor should not be less than 80 percent of the theoretical elastic bare-steel elongation of the unbonded length and shall not exceed the theoretical elastic bare-steel elongation of the unbonded length plus 50 percent of the bond length.
- b. The limiting minimum and maximum total elastic movement obtained from a proof test shall be identical to the limits for the performance test.
- c. The creep rate does not exceed 0.080 inches/log cycle of the performance test, proof test and/or creep test regardless of tendon length and load.
- d. The initial lift-off reading shows an anchor load within 5 percent of the specified lock-off load.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. **Prestressing Steel:** The prestressing steel tendons shall be DYWIDAG Threadbars, Grade 150 ksi conforming to ASTM Designation A722, Type II, cold stretched and stress relieved after the threading process, or approved equal. Deformations on threadbar shall conform to ASTM A615.
- B. **Anchorage and Splices:** Splices and anchorages shall be capable of developing 95% of the ultimate tensile strength of the prestressing steel and shall conform to the static strength requirements of the PTI "Guide Specification for Post-Tensioning Materials." A Dywidag Anchor Nut shall fit into the countersunk hole in the bearing plate. Anchor nuts shall be heavy-duty type with round head, as per manufactures specifications.
- C. **Plastic sheath,** 0.5 millimeters thick minimum, encapsulating the entire free length of the tendon conforming to ASTM AD1248.
- D. **Grout:** Grout inside of the corrugated PVC sheathing shall be a neat cement mixture using 4.5 to 5 gallons of water, and 15 ounces of Intraplast N per 95-lb. sack of cement. Cement shall conform to ASTM C150, "Portland Cement." Accelerators shall not be used.
- E. **Centralizers:** Centralizers shall be fabricated from a material, other than wood, that is not deleterious to the prestressing steel or corrugated PVC sheathing. The centralizers shall be of sufficient strength to support the weight of the anchor in the drilled hole and provide a minimum of 0.5" of grout cover. Centralizers shall be used for the bonded length only.
- F. **Corrosion Inhibiting Grease:** DYWIDAG post tensioning grease is a mastic corrosion inhibitor, waterproof, non- corrosive, and non-hardening sealing compound. Corrosion inhibiting grease shall have the physical properties listed in Table 3.2.1 of the Post-Tensioning Manual, 5<sup>th</sup> Edition by the Post-Tensioning Institute, or approved equal.

- G. Corrosion Protection Cap: After stressing operations, the tail of the prestressing steel shall be cut off at 1" minimum beyond the anchor nut. The anchor nut shall be completely encased within a hot dipped galvanized steel cap. The cap will be bolted to the bearing plate and a neoprene seal gasket will be used between cap flange and bearing plate. All voids within the steel cap shall be filled with DYWIDAG corrosion protection grease or cement grout.
- H. Bearing Plate Criteria:
1. The bearing plate shall be fabricated from mild steel conforming to ASTM A572, Grade 50 and shall effectively distribute the design force to the supporting concrete or structural steel element.
  2. Unless specified, bearing plate dimensions shall be designed for 95% of the minimum ultimate tensile strength (GUTS) of the prestressing steel. The concrete or structural steel support bearing stress shall not exceed allowable limits shown in the contract specifications and drawings. Bending stress of the bearing plate shall not exceed specified allowable yield strength (FY) of the steel material.

## **PART 3 - EXECUTION**

### **3.1 PROTECTION OF MATERIALS**

- A. Protect materials from damage, weather, and contaminants such as grease, oil, and dirt.

### **3.2 INSTALLATION**

- A. Perform work in accordance with "Guide Specification for Post-Tensioning Materials and Rock and Soil Anchors" (latest edition), published by the Post-Tensioning Institute. Conform to all applicable AISI, ACI, and ASTM standards.
- B. Drilling:
1. Holes for anchors shall be drilled where specified on the plans and within tolerances specified. The diameter of the drill bit should be not less than 1/8 inch smaller than the specified diameter. Allowable hole center tolerance is 2" from that shown on the drawings.
  2. The diameter of the hole shall be large enough to provide a minimum of 1" grout cover within the bonded length of the anchor assembly. Centralizers shall be placed at 8 ft on center over entire bonded length of the tendon. The hole shall be drilled to a depth 6" beyond the end of the anchor tendon.
  3. A rotary or percussion drilling method shall be used to drill anchor holes. The holes shall be drilled to a depth sufficient to provide the necessary bond length beyond a minimum unbonded length shown on the plans. The Contractor shall determine the bond length necessary to meet loading requirements specified herein. After the anchor holes have been drilled, the anchor grout shall be injected from the lowest point of the anchor. The grout well is placed after insertion of the tendons. The quantity of the grout and the grout pressures shall be recorded. Prior to installing each assembly into the anchor hole, the anchor assembly shall be clean and free of oil, grease or other extraneous substance. Excessive amounts of water shall not be used in any of the anchor installation procedures.

4. The holes for some or all of the anchors shall be tested for water tightness, if specified by the District's Geotechnical Engineer. When specified, the entire hole in rock shall be tested for water tightness by filling it with water and subjecting it to a pressure of 5 psi in excess of the hydrostatic head, as measured at the top of the hole. If the free length portion of the hole is fractured soil or rock, a packer or casing must be used to allow the bond length to be water pressure tested. If the leakage rate from the hole over a period of ten minutes exceeds 0.001 gallons per inch of diameter per foot of depth per minute, the hold should be consolidation grouted, redrilled and retested. Should the second water tightness test fail, the entire process should be repeated.
5. Holes adjacent to the hole being tested for water tightness shall be observed during the tests so that inter-hole connections may be detected and sealed. If artesian or flowing water is encountered in the drill hole, pressure will have to be maintained on the consolidation grout until the grout has initially set.

C. Insertion and Anchor Grouting:

1. It is the Contractor's responsibility to develop grouting means and methods that satisfy the Contract Documents requirements and develop the specified test loads.
2. The anchors shall be placed in accordance with the approved details and the recommendations of the anchor manufacturer to achieve the specified loading. Anchors shall be inserted in a drilled hole in such a manner that they are not damaged and the corrosion protection remains effective. Care must be taken to prevent bending of anchors installed through soil which is likely to settle. Centralizers shall be used to ensure that the tendon does not contact the wall of the drill hole.
3. Grouting operations shall generally be in accordance with Post-Tensioning Institute's "Recommended Practice for Grouting of Post-Tensioned Prestressed Concrete." Grouting shall always be injected at the lowest point of the tendon. Grout may be placed prior to inserting the tendon. Grout tubes, casing or drill rods can be used to place the grout.
4. When sheathed tendons are used, the bond length and free length can be grouted simultaneously. After grouting, the tendon shall remain undisturbed until the grout has cured.
5. If post-grouting is to be performed, it shall be performed on each anchor approximately 24 hours after primary grouting. The post-grout tubes(s) shall have check valves located at a maximum spacing of five feet in the bonded length. The post-grout tube configuration shall allow repetitive post-grouting and the Contractor shall provide repetitive post-grouting if required to develop the specified test loads.
6. The following data concerning the grout operation shall be recorded and kept on file.
  - a. Type of mixer
  - b. Water/cement ratio
  - c. Types of additives (if any)
  - d. Grouting pressure
  - e. Type of cement
  - f. Strength of Test Samples
7. Cutting of Thread Bar Protrusions: After successful testing of the anchors and acceptance by the District's Representative, the portion of the thread bar protruding beyond the stressing anchorage may be cut, if not otherwise required. Cutting shall be done according to the tendon manufacturer's recommendation and as approved by the District. Care shall be taken not to damage the tendon anchorage.



**3.3 CORRECTION OF DEFECTIVE WORK**

- A. Correction of defective work shall be the responsibility of the Contractor.
- B. Work not in compliance with the requirements of the Contract Documents shall be considered defective, unless otherwise directed in writing by the Architect.
- C. Corrected work shall conform to the requirements of the Contract Documents.
- D. The Contractor shall prepare a submittal documenting the defective work and proposed corrections and submit to the Architect for review. The submittal shall include a description of the defective work, the location of defective work, and shall be accompanied by supporting sketches, photographs, or both. Additionally, the submittal shall include similar documentation of the Contractor's proposed corrections.
- E. Correction of defective work shall not commence until the Architect has reviewed and accepted the submittal.
- F. Correction of defective work shall be inspected by the District's Testing Agency.

**3.4 CLEAN-UP**

- A. Remove from the site all debris resulting from the work of this Section.

**- END OF SECTION -**



# DIVISION 32 – EXTERIOR IMPROVEMENTS

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**- SECTION 32 1000 -****DEMOLITION**

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**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.
- B. Geotechnical Report:
  - 1. A geotechnical report is available and is titled "Geotechnical Investigation and Geologic Hazards Evaluation, College of San Mateo, Building 5N Modernization, 1700 W. Hillsdale Boulevard, San Mateo, California" prepared by Cornerstone Earth Group, dated February 1, 2008.

**1.2 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 0000 – Earthwork and Grading.
  - 2. Section 31 1000 – Site Preparation.
  - 3. Section 31 2333 – Trenching, Backfilling, and Compacting.

**1.3 SUBMITTALS**

- A. Comply with requirements of the Section 01 3219 – Submittal Procedures.

**1.4 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.

## 1.5 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 2333 – 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 SECTION -**



# DIVISION 33 – UTILITIES

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## **- SECTION 33 1000 -**

# **WATER SYSTEMS**

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### **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.
- B. Geotechnical Report:
  - 1. A geotechnical report is available and is titled "Geotechnical Investigation and Geologic Hazards Evaluation, College of San Mateo, Building 5N Modernization, 1700 W. Hillsdale Boulevard, San Mateo, California" prepared by Cornerstone Earth Group, dated February 1, 2008.

#### **1.2 SUMMARY**

- A. This section describes general requirements, products, and methods of execution relating to on-site domestic water and fire water systems serving all buildings and appurtenances. Unless otherwise noted, this section does not apply to irrigation water systems and water systems inside and within 5 feet of buildings. This section applies to:
  - 1. Domestic water distribution and services.
  - 2. Fire water distribution and services.
  - 3. Water storage tanks.
  - 4. Booster pumps.
- B. Contractor shall provide all labor, equipment, materials, and testing services unless otherwise noted.
- C. Related Sections:
  - 1. Section 31 2333 – Trenching, Backfilling, and Compacting.

#### **1.3 SUBMITTALS**

- A. Comply with provisions of Section 01 3219 – Submittal Procedures

#### **1.4 QUALITY ASSURANCE**

- A. Comply with the latest edition of the following Standards and Regulations:
  - 1. American Water Works Association (AWWA) and American National Standards Institute (ANSI):

- a. C104/A21.4 ANSI Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
- b. C105/A21.5 ANSI Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
- c. C110/A21.10 ANSI Standard for Ductile-Iron and Gray-Iron Fittings, 3 inch - 48 inch for Water.
- d. C111/A21.11 ANSI Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- e. C115/A21.15 ANSI Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
- f. C116/A21.16 ANSI Standard for Protective Fusion-Bonded Epoxy Coatings Interior & Exterior Surfaces for Ductile-Iron and Gray-Iron Fittings.
- g. C150/A21.50 ANSI Standard for Thickness Design of Ductile-Iron Pipe.
- h. C151/A21.51 ANSI Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
- i. C153/A21.53 ANSI Standard for Ductile-Iron Compact Fittings for Water Service.
- j. C500 Metal-Seated Gate Valves for Water Supply Service.
- k. C502 Dry-Barrel Fire Hydrants.
- l. C503 Wet-Barrel Fire Hydrants.
- m. C504 Rubber-Seated Butterfly Valves.
- n. C507 Ball Valves, 6 inches - 48 inches.
- o. C508 Swing-Check Valves for Waterworks Service, 2 inches - 24 inches NPS.
- p. C509 Resilient-Seated Gate Valves for Water Supply Service.
- q. C510 Double Check Valve Backflow Prevention Assembly.
- r. C511 Reduced-Pressure Principle Backflow Prevention Assembly.
- s. C512 Air Release, Air/Vacuum, and Combination Air Valves for Waterworks Service.
- t. C550 Protective Epoxy Interior Coating for valves and Hydrants.
- u. C600 Installation of Ductile-Iron Water Mains and their Appurtenances.
- v. C602 Cement- Mortar Lining of water Piplines in place- 4 inches and larger.
- w. C605 Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water.
- x. C651 Disinfecting Water Mains.
- y. C652 Disinfection of Water-Storage Facilities.
- z. C800 Underground Service Line Valves and Fittings for 1/2 inches - 2 inches.
- aa. C900 Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 inches - 12 inches, for Water Distribution.
- bb. C901 Polyethylene (PE) Pressure Pipe and Tubing, 1/2 inches through 3 inches, for Water Service.
- cc. C905 Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 inches - 48 inches.
- dd. C906 Polyethylene (PE) Pressure Pipe and Fittings, 4 inches - 63 inches, for Water Distribution and Transmission.
- ee. C907 Polyvinyl Chloride (PVC) Pressure Fittings for Water, 4 inches - 8 inches.
- ff. C908 PVC Self-Tapping Saddle Tees for Use on PVC Pipe.
- gg. D103 Factory-Coated Bolted steel Tanks for water Storage.

**WATER SYSTEMS**

2. National Fire Protection Association (NFPA):
  - a. NFPA 13 Standard for the Installation of Sprinkler Systems.
  - b. NFPA 14 Standard for the Installation of Standpipe, Private Hydrants, and Hose Systems.
  - c. NFPA 20 Standard for the Installation of Stationary Pumps for Fire Protection.
  - d. NFPA 22 Standard for Water Tanks for Private Fire Protection.
  - e. NFPA 24 Private Service Mains and their Appurtenances.
  - f. NFPA 25 Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.
3. Uni-Bell Plastic Pipe Association (UNI).
  - a. PUB 3 PVC Pipe – Technology Serving the Water Industry.
  - b. PUB 7 External Corrosion of Underground Water Distribution Piping Systems.
  - c. PUB 8 Tapping Guide for AWWA C900 Pressure Pipe.
  - d. PUB 9 Installation Guide for PVC Pressure Pipe.
  - e. B-8 Recommended Practice for the Direct Tapping of Polyvinyl Chloride (PVC) Pressure Water Pipe (Nominal Diameters 6-12 inch).
4. American Society of Testing and Materials (ASTM).
  - a. ASTM A536 Standard Specification for Ductile Iron Castings.
  - b. ASTM A674 Standard Practice for Polyethylene Encasement for Ductile Iron Pipe for Water or Other Liquids.
  - c. ASTM D1785 Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
  - d. ASTM D2241 Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe.
  - e. ASTM D2466 Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
  - f. ASTM D2564 Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
  - g. ASTM D2683 Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.
  - h. ASTM D3139 Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
  - i. ASTM D3261 Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
  - j. ASTM D3350 Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
  - k. ASTM F477 Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
  - l. ASTM F1055 Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing.
  - m. ASTM F1056 Standard Specification for Socket Fusion Tools for Use in Socket Fusion Joining Polyethylene Pipe or Tubing and Fittings.
  - n. ASTM A53/A53M Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
  - o. ASTM A795 Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use.

- p. ASTM A865 Standard Specification for Threaded Couplings, Steel, Black or Zinc-Coated (Galvanized) Welded or Seamless, for Use in Steel Pipe Joints.
- q. ASTM B88 Standard Specification for Seamless Copper Water Tube.
- 5. American Society of Mechanical Engineers (ASME).
  - a. ASME B16 series for valves, fittings, flanges, and gaskets applicable for use in water systems.
  - b. ASME B1.20.1 American Standard Tapered Pipe Threads for factory-threaded pipe and pipe fittings.
- 6. National Sanitation Foundation (NSF).
  - a. NSF/ANSI 14 Plastics Piping System Components and Related Materials.
  - b. NSF/ANSI 61 Standard for Drinking Water Systems Components – Health Effects.
- 7. Underwriters Laboratories, Inc. (UL).
  - a. UL 157 Standard for Safety for Gaskets and Seals.
  - b. UL 194 Standard for Safety for Gasketed Joints for Ductile-Iron Pipe and Fittings for Fire Protection Service.
  - c. UL 213 Rubber Gasketed Fittings for Fire-Protection Service.
  - d. UL 246 Standard for Safety for Hydrants for Fire-Protection Service.
  - e. UL 262 Standard for Safety for Gate Valves for Fire-Protection Service.
  - f. UL 312 Standard for Safety for Check Valves for Fire-Protection Service.
  - g. UL 405 Standard for Safety for Fire Department Connections.
  - h. UL 448 Standard for Safety for Pumps for Fire-Protection Service.
  - i. UL 789 Standard for Safety for Indicator Posts for Fire-Protection Service.
  - j. UL 860 Pipe Unions for Flammable and Combustible Fluids and Fire-Protection Service.
  - k. UL 1091 Standard for Safety for Butterfly Valves for Fire-Protection Service.
  - l. UL 1285 Pipe and Couplings, Polyvinyl Chloride (PVC), for Underground Fire Service.
  - m. UL 1468 Direct Acting Pressure Reducing and Pressure Restricting Valves.
  - n. UL 1478 Standard for Safety for Fire Pump Relief Valves.
- 8. FM Global (FM).
  - a. FM 1020 Automatic Water Control Valves.
  - b. FM 1045 Waterflow Detector Check Valves.
  - c. FM 1110 Indicator Posts.
  - d. FM 1111 Post-Indicator-Valve-Assembly.
  - e. FM 1112 Indicating Butterfly Valves.
  - f. FM 1120 and FM 1130 Fire Service Water Control Valves (OS&Y and NRS Type Gate Valves).
  - g. FM 1210 Swing Check Valves.
  - h. FM 1221 Backflow Preventers (Reduced Pressure Principle and Double Check Valve Types).
  - i. FM 1311 Centrifugal Fire Pumps (Horizontal, Split-Case Type).
  - j. FM 1312 Centrifugal Fire Pumps (Vertical-Shaft, Turbine Type).
  - k. FM 1319 Centrifugal Fire Pumps (Horizontal, End Suction Type).
  - l. FM 1361 Water Pressure Relief Valve.

- m. FM 1362 Pressure Reducing Valves.
  - n. FM 1371 Centrifugal Fire Pumps (In-Line Type).
  - o. FM 1510 Fire Hydrants (Dry Barrel Type) for Private Fire Service.
  - p. FM 1511 Fire Hydrants (Wet Barrel Type) for Private Fire Service.
  - q. FM 1530 Fire Department Connections.
  - r. FM 1610 Plastic Pipe & Fittings for Underground Fire Protection Service.
  - s. FM 1620 Pipe Joints & Anchor Fittings for Underground Fire Service Mains.
- 9. Plastics Pipe Institute (PPI).
    - a. Underground Installation of Polyethylene Pipe.
    - b. Polyethylene Joining Procedures.
    - c. Inspections, Test and Safety Considerations.
  - 10. American Association of State Highway and Transportation Officials (AASHTO) for H2O Loading.
  - 11. American Concrete Institute (ACI).
    - a. ACI 348 - Meter Pit Construction.
  - 12. Local Water District Standard Specifications and Details.
  - 13. Local Office of the Fire Marshal Regulations.
  - 14. Other authorities having jurisdiction.
- B. System Description: Grades and elevations are to be established with benchmarks referenced on Plans.
  - C. Comply with authorities having jurisdiction for the installation and testing of potable water piping and fire protection systems.
  - D. All testing of systems specified in this section shall be witnessed by representatives of the local water department or local authority. Provide at least 7 days notice.
  - E. The Contractor shall prepare shop plans and calculations, and obtain all required approvals for the fire water system of the proposed project. Contractor shall have shop plans and calculations stamped and signed by a Fire Protection Engineer, licensed by the State of California, as required by the local jurisdiction.

## **PART 2 - PRODUCTS**

### **2.1 PIPING**

- A. Water Distribution Main (pipe size 4 inches and larger).
  - 1. Ductile Iron Pipe (DIP): Pressure Class 350 pipe conforming to AWWA/ANSI C151/A21.5, cement-mortar lining conforming to AWWA/ANSI C104/A21.4, with standard thickness per AWWA/ANSI C150/A21.50. U.S. Pipe, American Cast Iron Pipe Company (ACIPCO), or approved equivalent.
    - a. Flanged ends shall conform to AWWA/ANSI C115/A21.15.
    - b. Rubber-gasket joints shall conform to AWWA/ANSI C111/A21.11.

2. Polyvinyl Chloride Pipe (PVC): Pressure Class 200, DR 14, spigot and gasket bell end, conforming to AWWA C900 or AWWA C905, with equivalent cast-iron pipe outer diameter (O.D.). J-M Manufacturing, PW Pipe, North American Pipe Company, or approved equivalent.
- B. Water Service Line (pipe size 3 inches and smaller)
1. Copper (Cu): Provide Type K soft or hard copper pipe conforming to ASTM B88.
  2. For pipe size 1 inches and smaller High Density Polyethylene Pipe (HDPE): PE3408, Pressure Class 200, DR 9 conforming to AWWA C901. PWPIPE or approved equivalent.

## 2.2 FITTINGS, GASKETS, COUPLINGS, SLEEVES, AND ASSEMBLY BOLTS AND NUTS

- A. For DIP: Provide fittings with pressure rating greater than or equal to that of the pipe. Provide flanged joints, mechanical joints, push-on joints, and insulating joints where indicated. Fittings with push-on joint ends shall conform to the same requirements as fittings with mechanical-joint ends. Provide mechanically coupled type joints using a sleeve-type mechanical coupling where indicated. Provide ends of pipe and fittings suitable for the specified joints. Fittings shall have cement-mortar lining conforming to AWWA/ANSI C104/A21.4.
1. Flanged Joints: Provide bolts, nuts, and gaskets in conformance with AWWA/ANSI C115/A21.15. Flanged fittings shall conform to AWWA/ANSI C110/A21.10 or C153/A21.53.
    - a. Provide flange for setscrewed flanges of ductile iron, ASTM A536, Grade 65-45-12, and conform to the applicable requirements of ASME B16.1, Class 250.
    - b. Provide setscrews for setscrewed flanges of 190,000 psi tensile strength, heat treated and zinc-coated steel.
    - c. Gaskets for setscrewed flanges shall conform to the applicable requirements for mechanical-joint gaskets specified in AWWA/ANSI C111/A21.11.
    - d. Design of setscrewed gaskets shall provide for confinement and compression of gasket when joint to adjoining flange is made.
    - e. Unless otherwise required, above ground flange assembly bolts shall be standard hex-head, cadmium plated machine bolts with American Standard Heavy, hot-pressed, cadmium plated hexagonal nuts. Buried flange nuts and bolts shall be as above except they shall be of Type 304 stainless steel.
  2. Mechanical Joints: Dimensional and material requirements for pipe ends, glands, bolts and nuts, and gaskets shall conform to AWWA/ANSI C111/A21.11.
  3. Push-on Joints: Provide shape of pipe ends and fitting ends, gaskets, and lubricant for joint assembly conforming to AWWA/ANSI C111/A21.11. Modify bell design fittings, as approved.
  4. Insulating Joints: Provide a rubber-gasketed or other suitable approved type of insulating joint or dielectric coupling which will effectively prevent metal-to-metal contact at the joint between adjacent sections of dissimilar metals.
    - a. Provide joint of the flanged type with insulating gasket, insulating bolt sleeves, and insulating washers.
    - b. Provide gasket of the dielectric type, full face, as recommended in AWWA/ANSI C115/A21.15.
    - c. Provide bolts and nuts as recommended in AWWA/ANSI C115/A21.15.



- B. For PVC: Fittings shall be DIP.
1. DIP fittings: Provide gray-iron or ductile-iron conforming to AWWA/ANSI C110/A21.10, with cement-mortar lining conforming to AWWA/ANSI C104/A21.4, and standard thickness, with equivalent cast-iron pipe O.D.
    - a. Fittings with push-on joint ends shall conform to the same requirements as fittings with mechanical-joint ends, except the bell design shall be modified, as approved, for push-on joint suitable for use with PVC plastic pipe.
    - b. Provide push-on joints, compression joints and mechanical joints where indicated between pipe and fittings, valves, and other accessories.
    - c. Mechanical joints, glands, bolts and nuts, and gaskets shall conform to AWWA/ANSI C111/A21.11.
    - d. All fittings shall be epoxy-coated, 10-mil thickness conforming to AWWA C550.
- C. For Cu:
1. Cast copper alloy solder-joint pressure fittings shall conform to ASME B16.18.
  2. Wrought copper solder-joint pressure fittings or wrought copper alloy unions shall conform to ASME B16.22
  3. Cast copper alloy flare fittings shall conform to ASME B16.26.
  4. Wrought copper alloy body, hexagonal stock, metal-to-metal seating surfaces, and solder-joint threaded ends shall conform to ASME B1.20.1.
  5. Compression connections shall be Mueller 110, Ford or approved equivalent.
- D. For PE:
1. Cast Copper Fittings shall conform to ASME B16.18.
  2. Cast Copper Compression Fittings and connections shall be Mueller 110 Ford or approved equivalent.

### 2.3 GATE VALVES AND BALL VALVES

- A. Gate Valves: Valves shall open by counterclockwise rotation of the valve stem. Provide valves with ends as appropriate for the adjoining pipe.
1. Stuffing boxes shall have O-ring stem seals. Provide stuffing boxes bolted and constructed so as to permit easy removal of parts for repair.
  2. Valves (2-1/2 inches and larger):
    - a. Provide valves conforming to AWWA C500 or AWWA C509 and of one manufacturer. Valves shall have a non-rising stem, a 2-inch square nut, and double-disc gates. Valves shall be rated for 250 psi maximum working pressure. Mueller 2360 series, ACIPCO, or approved equivalent.
    - b. For the domestic water system, valves shall also conform to ANSI/NSF 61.
    - c. For the fire water system, valves 2 inches through 16 inches in size shall also conform to UL 262 and FM 1120 or FM 1130 to a working pressure of 200 psi.
  3. Where a post indicator is shown, provide valve with an indicator post flange.
- B. Ball Valves: Valves shall open by counterclockwise rotation of the valve stem. Provide valves with ends as appropriate for the adjoining pipe.
1. Valves (2-inches and smaller):

- a. Provide valves conforming to AWWA C800 and of one manufacturer. Mueller 300 Series, Ford, or approved equivalent.
2. Provide valve with lockable operating nut or handle as shown on the Construction Documents.

## **2.4 BLOW-OFF VALVES, AIR RELEASE AND VACUUM VALVES, AND COMBINATION AIR VALVES**

- A. Blow-off valves: Provide valve and service size as shown in the Construction Documents. Provide 2-inch valves at low points of the piping system, and 4-inch valves at dead-ends of the piping system, unless otherwise directed by the Program Manager.
  1. 2-inch blow-off shall have a 2-inch vertical female iron pipe (FIP) inlet and a 2-inch normal pressure and temperature (NPT) nozzle outlet with cap. Valve shall open by counterclockwise rotation of a top-mounted 9/16-inch square operating nut. All working parts shall be serviceable without excavation. Kupferle/Truflo Model TF550, or approved equivalent.
  2. 4-inch blow-off shall have a 4-inch vertical FIP inlet and a 4-inch male iron pipe (MIP) outlet with cap. Valve shall open by counterclockwise rotation of a top-mounted 9/16-inch square operating nut. All working parts shall be serviceable without excavation. Kupferle/Truflo Model TF800, or approved equivalent.
- B. Air release and vacuum valves: Provide valve and service size as shown on the Construction Documents, and where there is an increase in the downward slope or a decrease in the upward slope of the piping system. Valve shall have cast-iron single valve body, and shall conform to AWWA C512. A compound lever system shall have a maximum operating pressure of 300psi. Provide a protective cap for the outlet of the valve. Provide universal air-vacuum type valves, Crispin Model UL, Apco, or approved equivalent.
- C. Combination air valves: Provide valve and service size as shown on the Construction Documents, and at high points and sharp changes in gradient of the pipe system. Valve shall have cast-iron single valve or double valve body, and shall conform to AWWA C512. A simple or compound lever system shall have a maximum operating pressure of 300psi. Provide a protective cap for the outlet of the valve. Crispin Model C, Apco, or approved equivalent.

## **2.5 CHECK VALVES**

- A. Check Valves: Valves shall have clear port opening and a cast-iron body. Provide spring-loaded or weight-loaded valves where indicated on the Construction Documents.
  1. For the domestic water system, provide swing-check type valves conforming to AWWA C508. Provide valves of one manufacturer. Mueller, Apco, or approved equivalent.
  2. For the fire water system, provide swing-check type valves conforming to FM 1210 and UL 312. Mueller, Watts, or approved equivalent.

## **2.6 PRESSURE REDUCING VALVES**

- A. Pressure Reducing Valves: Valves shall have a cast-iron body, conforming to ASTM A536, with epoxy interior coating conforming to AWWA, and rated to pressure class 300. Cla-Val Model 90-01, Singer, or approved equivalent.
  1. Valves shall have flanged ends.
  2. Valves sized 3-inches or smaller may have screwed ends.

## **WATER SYSTEMS**

**2.7 POST INDICATORS**

- A. Posts Indicators shall withstand up to 900 ft-lbs of operating torque, be free-standing, and tamper-proof.
- B. Post Indicators shall conform to UL 789 and FM 1110. Mueller, ACIPCO, or approved equivalent.

**2.8 VALVE BOXES, METER BOXES, FRAMES AND COVERS**

- A. Water Valve Box: Provide pre-cast concrete valve box for each buried valve. Provide box with steel or cast iron traffic cover marked "WATER". Christy Model G5 with G5C cover or approved equivalent.
- B. Valve or Meter Boxes: Contractor shall verify box size required for water system appurtenances as shown in the Construction Documents. Provide a precast concrete utility box for each buried appurtenance. Provide a traffic-rated lid for H2O loading. A non-traffic rated lid may be used for boxes located in landscape areas. Christy, or approved equivalent.

**2.9 BACKFLOW PREVENTERS**

- A. Provide backflow preventers as shown on the Construction Documents. Subject to District's approval. Backflow preventers on the fire water system shall be subject to approval by the local office of the fire marshal.
- B. Reduced Pressure Principle Assemblies (RPPA): Provide a cast-iron body RPPA consisting of two independently operating check valves with a pressure differential relief valve located between the two check valves, two shut-off valves and four test cocks. RPPA shall be tamper-proof and conform to AWWA C511. Febco 860, Watts, or approved equivalent.
- C. Double Check Detector Assemblies (DCDA): Provide a cast-iron body DCDA consisting of mainline double check assemblies in parallel with a bypass double check and meter assembly, two shut-off valves and four test cocks. DCDA shall be tamper-proof and conform to AWWA C510. Febco 806, Watts, or approved equivalent.

**2.10 FIRE DEPARTMENT CONNECTIONS AND WET STAND PIPES**

- A. Fire Department Connections (FDC): Provide FDC's with 2-1/2 inch female hose connections, sidewalk or free-standing type. Number of inlets shall be as shown on the Construction Documents. Clapper and spring check inlets shall each have a minimum capacity of 250 gpm, and be furnished with a cap and chain. Outlet shall be sized for simultaneous use of all inlets. Connection shall be branded "Building XX".
  - 1. 2-Way FDC: Connection shall conform to UL 405 or FM 1530. Elkhart, Croker, or approved equivalent.
  - 2. 3-Way FDC: Connection shall be subject to approval by the local water department or fire marshal. Elkhart, Croker, Potter-Roemer or approved equivalent.
  - 3. 4-Way FDC: Connection shall conform to UL 405. Potter-Roemer, Croker, or approved equivalent.
  - 4. 6-Way FDC: Connection shall be subject to approval by the local water department or fire marshal. Croker, Potter-Roemer or approved equivalent.

## 2.11 FIRE HYDRANTS

- A. Provide two 2-1/2 inch and one 4-1/2 inch outlets, with a 6-inch nominal inside diameter inlet and break-away type bolts. Hydrant shall have a working pressure of 250 psi and shall conform to AWWA C502 or C503, and be UL listed and FM approved. Provide hydrants of one manufacturer. Clow model 960 series or approved equivalent, subject to approval of the District and fire marshal.

## 2.12 THRUST BLOCKS AND PIPE RESTRAINTS

- A. Thrust Blocks: Provide thrust blocks in accordance with NFPA 24 Standards. Use concrete conforming to ASTM C94 having a minimum compressive strength of 2,500 psi at 28 days; or use concrete of a mix not leaner than one part cement, 2-1/2 parts sand, and 5 parts gravel, having the same minimum compressive strength.
- B. Pipe Restraints: Provide thrust restraint systems for fittings and joints as indicated on the Plans. Restrained lengths for onsite fire system will be as indicated on the Plans.
  - 1. For mechanical joint fittings and joints: Pipe restraints shall be "Mega-Lug" pipe restraint system by EBBA Iron, Inc., or approved equivalent.
  - 2. For push-on joint fittings and joints: Pipe restraints shall be "Field-Lok" gaskets by U.S. Pipe, or approved equivalent.
- C. Thrust blocks or mechanical pipe restraints may be used at Contractor's option, unless otherwise indicated on the Plans.
- D. Provide thrust blocks or mechanical pipe restraints at all fittings and changes in angle, alignment or elevation.
- E. Where depth or location of existing structures prohibit the use of standard thrust blocks, gravity blocks may be used. Conform to NFPA 24 Standards.

## 2.13 TAPPING SLEEVES AND TAPPING VALVES

- A. Tapping sleeves shall be epoxy coated and furnished with stainless steel washers, nuts and bolts. Mueller H-615 and H-619, Ford, or approved equivalent.
- B. Tapping valves shall have flanged inlet, Class 125, conforming to ASME B16.1 and furnished with stainless steel washers, nuts and bolts. Tapping valves shall be constructed with a mechanical joint outlet. Mueller T-687, T-642, T-681, or approved equivalent.

## 2.14 SERVICE SADDLES AND CORPORATION STOPS

- A. Service Saddles: Saddles shall conform to AWWA C800 and NSF 61.
  - 1. For DIP: Provide bronze or stainless steel body, double strap type with a 200 psi maximum working pressure. Mueller BR2 Series, Ford, or approved equivalent.
  - 2. For PVC: Provide bronze body, wide strap type. Mueller H-13000 Series, Ford, or approved equivalent.
  - 3. For PE: Per manufacturer's recommendations.

- B. Corporation Stops: Provide ground key type; bronze conforming to ASTM B61 or ASTM B62, for a working pressure of 100 psi. and suitable for the working pressure of the system.
  - 1. Ends shall be suitable for adjoining pipe and connections, solder-joint, or flared tube compression type joint.
  - 2. Threaded ends shall conform to AWWA C800.
  - 3. Coupling nut for connection to flared copper tubing shall conform to ASME B16.26.
  - 4. Mueller H-15000 Series with "CC" threads and a copper flare straight connection outlet, Ford, or approved equivalent.

## 2.15 IDENTIFICATION MATERIALS AND DEVICES

- A. Marker Tape: Provide marker tape consisting of metallic foil bonded to plastic film not less than 2-inches wide. Film shall be inert polyethylene plastic. Film and foil shall each not be less than 1-mil. thick. The tape shall be identified with lettering, not less than 3/4-inch high, "CAUTION: WATER MAIN BELOW", repeated at approximately 24-inch intervals.
- B. Tracer Wire for Nonmetallic Piping: Provide 12 gage, coated copper or aluminum wire not less than 0.10 inch in diameter in sufficient length to be continuous over each separate run of nonmetallic pipe. Wire shall be tied in at all valves.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine surfaces and areas for suitable conditions where water service is being installed.
- B. Do not begin installation until unsatisfactory conditions have been corrected.

### 3.2 LOCATION OF WATER LINES

- A. Where the location of the water line is not clearly defined by dimensions on the Plans, do not lay water line closer than 10 feet horizontally from any sewer line.
- B. Where water lines cross under gravity sewer lines, encase sewer line in concrete for a distance of at least 10 feet on each side of the crossing, unless sewer line is made of pressure pipe with rubber-gasketed joints and no joint is located within 3 feet horizontally of the crossing.
- C. Where water lines cross sewer force mains and inverted siphons, install water line at least 2 feet above these sewer lines.
- D. When joints in the sewer line are closer than 3 feet horizontally from the water line, encase sewer line joints in concrete.
- E. Do not lay water lines in the same trench with other utilities.
- F. Install water lines at 3'-0" minimum depth or as detailed on Plans.

### 3.3 INSTALLATION OF PIPING

- A. Inspection:
  - 1. Before placing in position, inspect pipe for noticeable defects. Clean the inside and outside of the pipe, fittings, valves, and accessories, and maintain in a clean condition.
  - 2. Remove fins and burrs from pipe and fittings.
  
- B. Pipe laying and jointing:
  - 1. Provide proper facilities for lowering sections of pipe into trenches.
  - 2. Do not drop or dump pipe, fittings, valves, or any other water line material into trenches.
  - 3. Cut pipe accurately to length established at the site and work into place without springing or forcing. Replace any pipe or fitting that does not allow sufficient space for proper installation of jointing material.
  - 4. Blocking or wedging between bells and spigots will not be permitted. Lay bell-and-spigot pipe with the bell end pointing in the direction of laying.
  - 5. Grade the pipeline in straight lines; avoid the formation of dips and low points.
  - 6. Support pipe at proper elevation and grade.
  - 7. Provide secure firm, uniform support. Wood support blocking will not be permitted.
  - 8. Lay pipe so that the full length of each section of pipe and each fitting rests solidly on the pipe bedding; excavate recesses to accommodate bells, joints, and couplings.
  - 9. Provide anchors and supports where indicated and where necessary for fastening work into place.
  - 10. Make proper provision for expansion and contraction of pipelines.
  - 11. Keep trenches free of water until joints have been properly made.
  - 12. Do not lay pipe when conditions of trench or weather prevent proper installation.
  - 13. All fittings shall be blocked with appropriately sized thrust blocks as shown in the Construction Documents.
  
- C. Installation of Tracer Wire:
  - 1. Install a continuous length of tracer wire for the full length of each run of nonmetallic pipe.
  - 2. Attach wire to top of pipe in such manner that it will not be displaced during construction operations.
  
- D. Connections to Existing Lines:
  - 1. Make connections to existing water lines after approval is obtained and with a minimum interruption of service on the existing line.
  - 2. Make connections to existing lines under pressure in accordance with the recommended procedures of a manufacturer of pipe of which the line being tapped is made.
  
- E. At the end of each work day, close open ends of pipe temporarily with wood blocks or bulkheads to keep out debris and contamination.

### 3.4 INSTALLATION OF DUCTILE-IRON PIPING

- A. Install pipe and fittings in accordance with requirements of AWWA C600 for pipe installation, joint assembly, valve-and-fitting installation, and thrust restraint.

- B. Jointing:
1. Provide push-on joints with the gaskets and lubricant specified for this type joint; assemble in accordance with the applicable requirements of AWWA C600 for joint assembly.
  2. Provide mechanical joints with the gaskets, glands, bolts, and nuts specified for this type joint; assemble in accordance with the applicable requirements of AWWA C600 for joint assembly and with the recommendations of AWWA C111.
  3. Provide flanged joints with the gaskets, bolts, and nuts specified for this type joint.
    - a. Install flanged joints up tight; avoid undue strain on flanges, fittings, valves, and other equipment and accessories.
    - b. Align bolt holes for each flanged joint.
    - c. Use full size bolts for the bolt holes; use of undersized bolts to make up for misalignment of bolt holes or for any other purpose will not be permitted.
    - d. Do not allow adjoining flange faces to be out of parallel to such degree that the flanged joint cannot be made watertight without over straining the flange.
    - e. Where flanged pipe and fitting have dimensions that do not allow the installation of a proper flanged joint as specified, replace it by one of proper dimensions.
    - f. Use setscrewed flanges to make flanged joints where conditions prevent the use of full-length flanged pipe. Assemble in accordance with the recommendations of the setscrewed flange manufacturer.
  4. Provide insulating joints with the gaskets, sleeves, washers, bolts, and nuts previously specified for this type joint. Assemble insulating joints as specified for flanged joints. Bolts for insulating sleeves shall be full size for the bolt holes.
  5. Ensure that there is no metal-to-metal contact between dissimilar metals after the joint has been assembled.
- C. Exterior Protection: Completely encase buried ductile iron pipelines and underground appurtenances with polyethylene wrap. Install 8-mil linear low-density polyethylene (LLD) film or 4-mil high-density cross-laminated (HDCL) film per manufacturer's recommendations and in accordance with AWWA/ANSI C105/A21.5 and ASTM A674.
- D. Pipe Anchorage:
1. Provide concrete thrust blocks or restrained joints for pipe anchorage, except where metal harness is indicated on the Construction Documents.
  2. Pipe anchorage shall be in accordance with NFPA 24 Standards.

### 3.5 INSTALLATION OF POLYVINYL CHLORIDE PIPING

- A. Install pipe and fittings in accordance with the requirements of UNI B-3 for the following:
1. The laying of pipe, joining PVC pipe to fittings and accessories.
  2. The setting of hydrants, valves, and fittings.
- B. Comply with the recommendations for pipe joint assembly and appurtenance installation in AWWA Manual M23, Chapter 7, "Installation".
- C. Comply with the applicable requirements of AWWA C600 for joint assembly, and with the recommendations of Appendix A to AWWA C111.

D. Jointing:

1. Provide push-on joints with the elastomeric gaskets specified for this type joint, using either elastomeric-gasket bell-end pipe or elastomeric-gasket couplings.
2. For pipe-to-pipe push-on joint connections, use only pipe with push-on joint ends having factory-made bevel.
3. For push-on joint connections to metal fittings, valves, and other accessories, cut spigot end of pipe off square and re-bevel pipe end to a bevel approximately the same as that on ductile-iron pipe used for the same type of joint.
4. Use an approved lubricant recommended by the pipe manufacturer for push-on joints.
5. Assemble push-on joints for connection to fittings, valves, and other accessories in accordance with the requirements of UNI B-3 for joining PVC pipe to fittings and accessories and with the applicable requirements of AWWA C600 for joint assembly.
6. Make compression-type joints/mechanical-joints with the gaskets, glands, bolts, nuts, and internal stiffeners previously specified for this type joint. Cut off spigot end of pipe for compression-type joint or mechanical-joint connections and do not re-bevel.
7. Assemble joints made with sleeve-type mechanical couplings in accordance with the recommendations of the coupling manufacturer using internal stiffeners as previously specified for compression-type joints.

E. Pipe Anchorage:

1. Provide concrete thrust blocks or restrained joints for pipe anchorage, except where metal harness is indicated on the Construction Documents.
2. Anchorage shall be in accordance with the requirements of UNI B-3 and in accordance with NFPA 24 Standards for reaction or thrust blocking and plugging of dead ends, except that size and positioning of thrust blocks shall be as indicated on the Construction Documents.

### 3.6 INSTALLATION OF POLYETHYLENE PIPING

A. Install pipe, fittings, and appurtenances in accordance with PPI and Manufacturer's Recommendations.

B. Jointing:

1. Provide mechanical joints, compression fittings, or flanges as recommended by the manufacturer.
2. Jointing shall be performed using proper equipment and machinery by trained and certified personnel.
3. Joints, fittings and tools shall be clean and free of burrs, oil, and dirt.
4. Butt fusion:
  - a. Pipe ends shall be faced to establish clean, parallel mating surfaces.
  - b. Align and securely fasten the components to be joined squarely between the jaws of the joining machine.
  - c. Heat the ends of the pipe to the pipe manufacturer's recommended temperature interface pressure and time duration. A pyrometer or other surface temperature measuring device should be used to insure proper temperature of the heating tool. Temperature indicating crayons shall not be used on a surface which will come into contact with the pipe or fitting.



- d. Prevent molten plastic from sticking to the heater faces. Molten plastic on the heater faces shall be removed immediately according to the tool manufacturer's instructions.
  - e. Bring the molten ends together with sufficient pressure to properly mix the pipe materials and form a homogeneous joint. Hold the molten joint under pressure until cooled adequately to develop strength. Refer to the Manufacturer's recommendations for temperature, pressure, holding, and cooling times.
  - f. Remove the inside bead from the fusion process using Manufacturer's recommended procedure.
5. Socket fusion:
- a. Mixing manufacturers' heating tools and depth gages will not be allowed unless the tools conform to ASTM F1056.
  - b. Pipe ends shall be faced square to establish clean, parallel mating surfaces.
  - c. Clamp the cold ring on the pipe at the proper position using a depth gauge.
  - d. Heat the tool to the pipe manufacturer's recommended temperature. A pyrometer or other surface temperature measuring device should be used to insure proper temperature. Temperature indicating crayons shall not be used on a surface which will come into contact with the pipe or fitting.
  - e. Follow manufacturer's recommendations for bringing the hot tool faces into contact with the outside surface of the end of the pipe and the inside surface of the socket fitting.
  - f. Simultaneously remove the pipe and fitting from the tool.
  - g. Inspect the melt pattern for uniformity and immediately insert the pipe squarely and fully into the socket of the fitting until the fitting contacts the cold ring. Do not twist the pipe or fitting during or after the insertion.
  - h. Hold or block the pipe in place during cooling.
6. Electrofusion:
- a. Unless the operation is for a saddle-type electrofusion joint, pipe ends shall be faced square to establish clean, parallel mating surfaces.
  - b. Clamp the pipe and fitting at the proper position in the fixture.
  - c. Connect the electrofusion control box to the fitting and to the power source. Apply the electric current using manufacturer's instructions.
  - d. Allow the joint to cool before removing the clamping fixtures.

### 3.7 INSTALLATION OF VALVES

- A. Install gate valves conforming to AWWA C500 and UL 262 in accordance with the requirements of AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix (Installation, operation, and Maintenance of Gate Valves) to AWWA C509.
- B. Install gate valves conforming to AWWA C509 in accordance with the requirements of AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix (Installation, Operation, and Maintenance of Gate Valves) to AWWA C509.
- C. Install gate valves on PVC water mains in addition in accordance with the recommendations for appurtenance installation in AWWA Manual M23, Chapter 7, "Installation."

- D. Install check valves in accordance with the applicable requirements of AWWA C600 for valve-and-fitting installation, except as otherwise indicated.
- E. Provide and assemble joints to gate valves and check valves as specified for making and assembling the same type joints between pipe and fittings.

### **3.8 INSTALLATION OF VALVE AND METER BOXES**

- A. Boxes shall be centered over the appurtenance so as not to transmit shock or stress. Covers shall be set flush with the surface of the finished pavement, or as shown in the Construction Documents. Backfill shall be placed around the boxes and compacted to the specified level in a manner that will not damage or displace the box from proper alignment or grade. Misaligned boxes shall be excavated, plumbed, and backfilled at no additional cost to the District.

### **3.9 INSTALLATION OF HYDRANTS**

- A. Install hydrants, except for metal harness, plumbed vertical, in accordance with AWWA C600 for hydrant installation and as indicated.
- B. Provide and assemble joints as specified for making and assembling the same type joints between pipe and fittings. Hydrants shall be set so that mounting bolts clear the top of finished grade by three inches so bolts may be easily replace if needed.
- C. Provide metal harness as specified under pipe anchorage requirements for the respective pipeline material to which hydrant is attached.

### **3.10 SERVICE LINE CONNECTIONS TO WATER MAINS**

- A. Connect service lines of size shown on plans to the main with a rigid connection or a corporation stop and gooseneck. Install a gate valve on the service line.
- B. Connect service lines to ductile-iron water mains in accordance with AWWA C600 for service taps.
- C. Connect service lines to PVC plastic water mains in accordance with UNI-B-8 and the recommendations of AWWA Manual M231, Chapter 9, "Service Connections."

### **3.11 INSTALLATION OF BACKFLOW PREVENTERS**

- A. Backflow devices shall be installed horizontal and level, with three feet minimum clearances from obstructions.

### **3.12 HYDROSTATIC PIPELINE TESTING**

- A. Requirements:
  - 1. After the pipe has been laid and backfilled, perform hydrostatic pressure tests.
  - 2. Do not conduct tests until at least 12 hours have elapsed since pipe laying and at least 5 days have elapsed since placing of concrete thrust blocks.

3. Fill the pipe with water which shall remain without external application of pressure for 24 hours before tests are conducted.
4. Prior to hydrostatic testing, flush pipe system with fresh water until piping is free of dirt and foreign matter.
5. Apply pressure by a pump and measured by a test gage. All necessary apparatus and labor for conducting the pressure and leakage tests shall be furnished by the Contractor.
6. Ensure the release of air from the line during filling, and prevent collapse due to vacuum when dewatering the line.
7. For pressure test, use a hydrostatic pressure not less than 200 psi. The duration of the test shall not be less than 4 hours with the variation in pressure of not more than 5 psi for the duration of the test.

**B. Leakage Tests:**

1. Perform tests at the same time as pressure tests.
2. Leakage rate shall be measured for at least 4 hours with a certified water meter, or other approved method. If requested, meter certification shall be submitted to the District for approval prior to testing.
3. Leakage shall not be measured by a drop in pressure in a test section over a period of time.
4. Leakage at mechanical couplings and joints, tapping sleeves, saddles, flanged joints, and copper piping will not be accepted. Correct any visible leaks.
5. Push-on joints: Test ductile iron pipe for leakage in accordance with AWWA C600 as shown in the following table:

**TABLE 1**

Allowable Leakage per 1000 feet of DIP Pipeline (Gal/Hr)

Average Test Pressure (psi)	Nominal Pipe Diameter - Inches									
	3	4	6	8	10	12	14	16	18	20
300	0.39	0.52	0.78	1.04	1.30	1.56	1.82	2.08	2.34	2.60
275	0.37	0.50	0.75	1.00	1.24	1.49	1.74	1.99	2.24	2.49
250	0.36	0.47	0.71	0.95	1.19	1.42	1.66	1.90	2.14	2.37
225	0.34	0.45	0.68	0.90	1.13	1.35	1.58	1.80	2.03	2.25
200	0.32	0.43	0.64	0.85	1.06	1.28	1.48	1.70	1.91	2.12

6. When the pipeline under test contains sections of various diameters, the allowable leakage will be the sum of the computed leakage for each size.
7. Test polyvinyl chloride pipe for leakage in accordance with the recommendations of the Uni-Bell Plastic Pipe Association (UNI) as shown in the following table:

**TABLE 2**

Allowable Leakage per 1000 feet or 50 joints of PVC Pipeline (Gal/Hr)

Nominal Pipe Size (inches)	Average Test Pressure in Line (psi.)	
	200	250
4	0.38	0.43
6	0.57	0.64
8	0.76	0.85
10	0.96	1.07
12	1.15	1.28
14	1.34	1.50
16	1.53	1.71
18	1.72	1.92
20	1.91	2.14

8. Should any section of new pipe fail to pass either test, locate and repair the defective pipe and repeat the test.

**3.13 STERILIZATION AND FLUSHING**

A. General:

1. Disinfect domestic water lines, mains, and branches by chlorination in accordance with AWWA C601 and as herein specified.

B. Sterilization Methods:

1. Liquid Chlorine Solution Method:
  - a. Flush all foreign matter from mains, branch runs, hydrant runs, and installed services.
  - b. Introduce liquid chlorine solution at appropriate locations to assure uniform distribution through the facilities at the proper concentration.
  - c. Do not use installed copper service lines to convey the concentrated chlorine solution to the mains.
  - d. The sanitizing solution shall be retained in the facilities for a period of 24 hours after which each service, hydrant run, branch run and dead end shall be flushed until:
    - 1) Residual chlorine is less than 1 part per million.
    - 2) Residual chlorine is no greater than the concentration of chlorine in the water supplied for flushing.
  - e. Chlorine shall be a 1 percent solution (containing 10,000 parts per million available chlorine) or shall be obtained by use of dry chlorine in tablet form firmly attached to inside tope of the pipe.
  - f. The required concentration of chlorine in the pipe is 50 parts per million. This concentration may be attained by adding 5 gallons of the chlorine solution to 1,000 gallons of water.

- g. The weight of chlorine or chlorine compound required to make a 1 percent chlorine solution is as follows:

**TABLE 3**

One-Percent Chlorine Solution Mix

AMOUNT OF PRODUCT COMPOUND		QUANTITY OF WATER (in gallons)
High-Test Calcium Hypochlorite (65-70% Cl)	1 pound	7.50
Chlorinated Lime (32-35% Cl)	2 pounds	7.50
Liquid Laundry Bleach (5.25% Cl)	1 gallon	4.25
Liquid Chlorine (100% available chlorine)	0.62 pounds	7.50

2. HTH Tablet Method:

- a. The required concentration of chlorine in the mains may be obtained by the use of HTH tablets as produced by Olin Mathieson in the following quantities or approved equivalent:

**TABLE 3**

HTH Tablet (70%) Dosage

Number of Tablets Per Length of Pipe

Length of Section	DIAMETER OF PIPE				
	4 inches	6 inches	8 inches	10 inches	12 inches
13 feet or less	1	2	3	4	6
18 feet	1	2	3	5	6
20 feet	1	2	3	5	7
30 feet	2	3	5	7	10
36 feet	2	3	5	8	12
40 feet	2	4	6	9	14
100 feet	4	9	15	23	30

- b. Tablets are to be fastened to the inside top surface of each length of pipe using "Permatex No. 1" no earlier than the day pipe is laid.
- c. Tablets shall not be installed in the pipe and left overnight before laying and shall not be accessible at any time for casual pilferage by the general public or by children. Tablets shall be stored in a hermetically sealed container.
- d. The new water lines are to be slowly filled with water. Air is to be exhausted from each dead end, branch run, hydrant run, and installed service.

- e. Water shall be retained for a period of 24 hours, after which each service, hydrant run, branch run and dead end shall be thoroughly flushed to clear foreign matter and until:
    - 1) Residual chlorine concentration is less than 1 part per million.
    - 2) Residual chlorine is no greater than the concentration of chlorine in the water supplied for flushing.
- C. Bacteriological Testing:
- 1. Samples shall be gathered and tests conducted at the expense of the Contractor by a laboratory approved by the District.
  - 2. Samples are to be taken at representative points not less than one test per every 500 feet of pipe, plus one test at each end of the pipe; or as required by the District and inspector having jurisdiction.
  - 3. The new water lines shall remain isolated and out of service until satisfactory test results have been obtained that:
    - a. All samples shall be tested and show the absence of Coliform Organisms, the presence of free chlorine residual (and shall equal to that of source water). Turbidity, PH and Heterotrophic Plate Count shall also match that of the source water.
    - b. District has accepted the results as indicative of the bacteriological condition of the facilities.
    - c. If unsatisfactory or doubtful results are obtained from the initial sampling, repeat the chlorination process until acceptable test results are reported.
    - d. Source water shall be that of the campus.

**- END OF SECTION -**

**- SECTION 33 3000 -****SANITARY SEWER**

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**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.
- B. Geotechnical Report:
  - 1. A geotechnical report is available and is titled "Geotechnical Investigation and Geologic Hazards Evaluation, College of San Mateo, Building 5N Modernization, 1700 W. Hillsdale Boulevard, San Mateo, California" prepared by Cornerstone Earth Group, dated February 1, 2008.

**1.2 SUMMARY**

- A. This section describes general requirements, products, and methods of execution relating to on-site sanitary sewerage 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; the State of California Department of Transportation.
  - 1. Sanitary Sewer System, including piping and structures.
- B. Contractor shall provide all labor, equipment, and materials, unless otherwise noted.
- C. Related Sections:
  - 1. Section 31 2333 – Trenching, Backfilling, and Compacting.

**1.3 SUBMITTALS**

- A. Comply with provisions of Section 01 3219 – Submittal Procedures.

**1.4 QUALITY ASSURANCE**

- A. Comply with the latest editions of the following Standards and Regulations:
  - 1. American Concrete Pipe Association (ACPA).
    - a. ACPA 01-102 (1988) Concrete Pipe Handbook.
    - b. ACPA 01-103 (1995) Concrete Pipe Installation Manual.
  - 2. American National Standards Institute (ANSI).
    - a. ANSI B18.5.2.1M (1981; R 1995) Metric Round Head Short Square Neck Bolts.

3. American Railway Engineering & Maintenance-of-Way Association (AREMA).
  - a. AREMA 1-5 (2001) Pipelines.
4. American Society for Testing and Materials (ASTM).
  - a. A 123/A 123M (2001a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - b. A 307 (2000) Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
  - c. A 47 (1999) Ferritic Malleable Iron Castings.
  - d. A 47M (1990; R 1996) Ferritic Malleable Iron Castings (Metric).
  - e. A 48 (1994ae1) Gray Iron Castings.
  - f. A 48M (1994e1) Gray Iron Castings (Metric).
  - g. A 536 (1984; R 1999e1) Ductile Iron Castings.
  - h. A 563 (2000) Carbon and Alloy Steel Nuts.
  - i. A 563M (2001) Carbon and Alloy Steel Nuts (Metric).
  - j. A 74 (1998) Cast Iron Soil Pipe and Fittings.
  - k. A 746 (1999) Ductile Iron Gravity Sewer Pipe.
  - l. C 12 (2002) Installing Vitrified Clay Pipe Lines.
  - m. C 14 (1999) Concrete Sewer, Storm Drain, and Culvert Pipe.
  - n. C 14M (1999) Concrete Sewer, Storm Drain, and Culvert Pipe (Metric).
  - o. C 150 (2002) Portland Cement.
  - p. C 260 (2001) Air-Entraining Admixtures for Concrete.
  - q. C 270 (2001a) Mortar for Unit Masonry.
  - r. C 301 (1998) Vitrified Clay Pipe.
  - s. C 33 (2001a) Concrete Aggregates.
  - t. C 361 (1999) Reinforced Concrete Low-Head Pressure Pipe.
  - u. C 361M (1999) Reinforced Concrete Low-Head Pressure (Metric).
  - v. C 425 (2002) Compression Joints for Vitrified Clay Pipe and Fittings.
  - w. C 443 (2001) Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
  - x. C 443M (2001) Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets (Metric).
  - y. C 478 (1997) Precast Reinforced Concrete Manhole Sections.
  - z. C 478M (1997) Precast Reinforced Concrete Manhole Sections (Metric).
  - aa. C 494 Chemical Admixtures for Concrete.
  - bb. C 564 (1997) Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
  - cc. C 700 (2002) Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated.
  - dd. C 76 (2000) Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
  - ee. C 76M (2000) Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (Metric).
  - ff. C 828 (2001) Low-Pressure Air Test of Vitrified Clay Pipe Lines.
  - gg. C 920 (2002) Elastomeric Joint Sealants.
  - hh. C 923 (2000) Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals.
  - ii. C 923M (1998) Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals (Metric).



- jj. C 924 (1989; R 1997) Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method.
- kk. C 924M (1989; R 1998) Testing Concrete Pipe Sewer Liner by Low-Pressure Air Test Method (Metric).
- ll. C 94 (1994) Ready-Mixed Concrete.
- mm. C 94/C 94M (2000e2) Ready-Mixed Concrete.
- nn. C 969 (2000) Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines.
- oo. C 969M (2000) Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines (Metric).
- pp. C 972 (2000) Compression-Recovery of Tape Sealant.
- qq. C 990 (2001a) Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealers.
- rr. C 990M (2001a) Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants (Metric).
- ss. D 1784 (1999a) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
- tt. D 1785 (1999) Poly(Vinyl Chloride)(PVC) Plastic Pipe, Schedules 40, 80, and 120.
- uu. D 2235 (2001) Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
- vv. D 2241 (2000) Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
- ww. D 2321 (2000) Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
- xx. D 2412 (1996a) Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.
- yy. D 2464 (1999) Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
- zz. D 2466 (2001) Poly(Vinyl Chloride)(PVC) Plastic Pipe Fittings, Schedule 40.
- aaa. D 2467 (2001) Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
- bbb. D 2680 (2001) Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping.
- ccc. D 2751 (1996a) Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
- ddd. D 2996 (2001) Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.
- eee. D 2997 (2001) Centrifugally Cast "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.
- fff. D 3034 (2000) Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- ggg. D 3139 (1998) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
- hhh. D 3212 (1996a) Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
- iii. D 3262 (2002) "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer Pipe.
- jjj. D 3350 (2002) Polyethylene Plastics Pipe and Fittings Materials.
- kkk. D 3753 (1999) Glass-Fiber-Reinforced Manholes.
- lll. D 3840 (2001) "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Fittings for Non-pressure Applications.

- mmm. D 4101 (2002) Propylene Injection and Extrusion Materials.
  - nnn. D 412 (1998a) Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers – Tension.
  - ooo. D 4161 (2001) "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Joints Using Flexible Elastomeric Seals.
  - ppp. D 624 (2000) Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
  - qqq. F 1336 (2002) Poly(Vinyl Chloride) (PVC) Gasketed Sewer Fittings.
  - rrr. F 402 (1993; R 1999) Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings.
  - sss. F 405 (1997) Corrugated Polyethylene (PE) Tubing and Fittings.
  - ttt. F 477 (1999) Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
  - uuu. F 714 (2001) Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
  - vvv. F 758 (1995; R 2000) Smooth-Wall Poly(Vinyl Chloride) (PVC) Plastic Underdrain Systems for Highway, Airport, and Similar Drainage.
  - www. F 794 (1999) Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.
  - xxx. F 894 (1998a) Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe.
  - yyy. F 949 (2001a) Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings.
5. ASME International (ASME).
- a. B1.20.1 (1983; R 2001) Pipe Threads, General Purpose, Inch.
  - b. B16.1 (1998) Cast Iron Pipe Flanges and Flanged Fittings.
  - c. B18.2.2 (1987; R 1999) Square and Hex Nuts.
  - d. B18.5.2.2M (1982; R 2000) Metric Round Head Square Neck Bolts.
6. American Water Works Association (AWWA).
- a. C104 (1995) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
  - b. C105 (1999) Polyethylene Encasement for Ductile-Iron Pipe Systems.
  - c. C110 (1998) Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (76 mm through 1219 mm), for Water.
  - d. C111 (2000) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
  - e. C115 (1999) Flanged Ductile-Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges.
  - f. C151 (1996) Ductile-Iron Pipe, Centrifugally Cast, for Water.
  - g. C153 (2000) Ductile-Iron Compact Fittings for Water Service.
  - h. C302 (1995) Reinforced Concrete Pressure Pipe, Noncylinder Type.
  - i. C600 (1999) Installation of Ductile-Iron Water Mains and Their Appurtenances.
  - j. C606 (1997) Grooved and Shouldered Joints.
  - k. C900 (1997) Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Distribution.
  - l. M23 (1980) Manual: PVC Pipe - Design and Installation.
  - m. M9 (1995) Manual: Concrete Pressure Pipe.
7. California Department of Transportation (CDT): Standard Specifications:

- a. Section 55:
  - b. Section 70:
  - c. Section 75:
  - 8. Cast Iron Soil Pipe Institute (CISPI).
    - a. 301 (2000) Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
    - b. 310 (1997) Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
  - 9. Uni-Bell PVC Pipe Association (UBPPA).
    - a. UNI-B-3 (1992) Recommended Practice for the Installation of Polyvinyl Chloride (PVC) Pressure Pipe (Nominal Diameters 4-36 Inch).
    - b. UNI-B-6 (1990) Recommended Practice for the Low-Pressure Air Testing of Installed Sewer Pipe.
  - 10. City of San Mateo Standard Plans and Specifications.
  - 11. American Association of State Highway and Transportation Officials (AASHTO) for H20 Loading.
  - 12. American Concrete Institute (ACI).
  - 13. Other authorities having jurisdiction.
- B. System Description: Grades and elevations are to be established with reference to the benchmarks referenced on the Plans.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Storage
  - 1. Piping: Inspect materials delivered to site for damage; store with minimum of handling. Store materials on site in enclosures or under protective coverings. Store plastic piping and jointing materials and rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes and fittings free of dirt and debris.
  - 2. Metal Items: Check upon arrival; identify and segregate as to types, functions, and sizes. Store off the ground in a manner affording easy accessibility and not causing excessive rusting or coating with grease or other objectionable materials.
- B. Handling
  - 1. Handle pipe, fittings, and other accessories in such manner as to ensure delivery to the trench in sound undamaged condition. When handling lined pipe, take special care not to damage linings of pipe and fittings; if lining is damaged, make satisfactory repairs. Carry, do not drag, pipe to trench.

## PART 2 - PRODUCTS

### 2.1 PIPING

- A. Polyvinyl Chloride (PVC) Pipe: PVC pipe conforming to ASTM D3034, SDR 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. Vitrified Clay Pipe (VCP): VCP and fitting shall conform to ASTM C700, Extra Strength.

## 2.2 MANHOLES

- A. Manholes shall be pre-cast concrete of the size and shape shown on the Plans 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 "SANITARY SEWER" 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 approved equivalent. Use of a water-resistant admix is acceptable, at contractor option.
- D. Frames and lids for manholes shall be match-marked in pairs before delivery to the job site. The lids shall fit into their frames without rocking.
- 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 Plans. 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 "A" containing 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 CLEAN-OUTS

- A. A box shall be provided for each clean-out. Boxes shall be pre-cast concrete with cast iron frame and cover marked "SAN SEWER"; Christy G5 with G5C lid or approved equivalent.

## 2.4 PIPE TO STRUCTURE CONNECTOR/SEAL

- A. A flexible pipe to manhole connector shall be used for all pipe penetrations to pre-cast 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.

2. 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.
3. 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.
4. Connectors shall be Z-LOK or G3 connectors manufactured by A-LOK Products Inc. or approved equivalent.

## **PART 3 - EXECUTION**

### **3.1 PIPE INSTALLATION**

- A. Pipe shall be installed in conformance with Section 31 2333 – Trenching, Backfilling, and Compacting, and manufacturer's recommendations.
- B. Pipe laying:
  1. No pipe shall be laid until the Geotechnical Project Manager 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 sewer 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 bulled 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.
- 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 Plans, 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 AIR TESTING AND FLUSHING

- A. All new sections of sanitary sewer shall be tested using the following procedures:
  1. Test is conducted between two consecutive manholes, or as directed by the Project Manager.
  2. The test section of the sewer shall be plugged at each end. One of the plugs used at the manhole shall be tapped and equipped for the air inlet connection for filling the line from an air compressor.
  3. All service laterals, stubs, and fittings into the sewer test section shall be properly capped or plugged and carefully braced against the internal pressure to prevent air leakage by slippage and blowout.
  4. Connect air hose to tapped plug selected for the air inlet. Connect the other end of the air hose to the portable air control equipment, which consists of valves and pressure gauges used to control the air entry rate into the sewer test section, and to monitor the air pressure in the pipeline. More specifically, the air control equipment includes a shut-off valve, pressure regulating valve, pressure reduction valve, and a monitoring pressure gauge having a pressure range from 0-5 psi. The gauge shall have minimum divisions of 0.10 psi and an accuracy of 0.40 psi.
  5. Connect another air hose between the air compressor (or other source of compressed air) and the air control equipment. This completes the test equipment set-up. Test operations may commence.
  6. Supply air to the test section slowly, filling the pipeline until a constant pressure of 3.5 psig is maintained. The air pressure must be regulated to prevent the pressure inside the pipe from exceeding 5.0 psig.
  7. When constant pressure of 3.5 psig is reached, throttle the air supply to maintain the internal pressure above 3.0 psig for at least 5 minutes. This time permits the temperature of the entering air to equalize with the temperature of the pipe wall. During this stabilization period, it is advisable to check all capped and plugged fittings with a soap solution to detect any leakage at these connections. If leakage is detected at any cap plug, release the pressure in the line and tighten all leaky caps and plugs. Start the test operation again by supplying air. When it is necessary to bleed off the air to tighten or repair a faulty plug, a new 5-minute interval must be allowed after the pipeline has been refilled.
  8. After the stabilization period, adjust the air pressure to 3.5 psig and shut-off or disconnect the air supply. Observe the gauge until the air pressure reached 3.0 psig. At 3.0 psig, commence timing with a stopwatch until the pressure drops to 2.5 psig, at which time the stop watch is stopped. The time required, as shown on the stopwatch, for a pressure loss of 0.5 psig is used to compute the air loss.
  9. If the time, in minutes and seconds, for the air pressure drop from 3.0 to 2.5 psi is greater than that shown in the following table for the designated pipe size, the section undergoing test shall have passed and shall be presumed to be free of defects. The test may be discontinued at any time.
  10. If the time, in minutes and seconds, for the 0.5 psig drop is less than that shown in the following table for the designated pipe size, the section of the pipe shall not have passed the test; therefore, adequate repairs must be made and the line retested.

## Requirements for Air Testing

Pipe Size (in inches)	Time	
	Minutes	Seconds
4	2	32
6	3	50
8	5	6
10	6	22
12	7	39
14	8	56
15	9	35
16	10	12
18	11	34
20	12	30

(For larger diameter pipe use the following: Minimum time in seconds = 462 X pipe diameter in feet).

11. For 8 inch and smaller pipe, only: if, during the 5 minute saturation period, pressure drops less than 0.5 psig after the initial pressurization and air is not added, the pipe section undergoing test shall have passed.
12. Multi-pipe sizes: when the sewer line undergoing test is 8 inch or larger diameter pipe and includes 4 inch or 6 inch laterals, the figures in the table for uniform sewer main sizes will not give reliable or accurate criteria for the test. Where multi-pipe sizes are to undergo the air test, the Project Manager can compute the "average" size in inches which is then multiplied by 38.2 seconds. The results will give the minimum time in seconds acceptable for a pressure drop of 0.5 psig for the "averaged" diameter pipe.
13. Adjustment Required for Groundwater:
  - a. An air pressure correction is required when the ground water table is above the sewer line being tested. Under this condition, the air test pressure must be increased .433 psi for each foot the ground water level is above the invert of the pipe.
  - b. Where ground water is encountered or is anticipated to be above the sewer pipe before the air testing will be conducted, the following procedure shall be implemented at the time the sewer main and manholes are constructed.
    - 1) Install a ½ inch diameter pipe nipple (threaded one or both ends, approximately 10 inch long) through the manhole wall directly on top of one of the sewer pipes entering the manhole with threaded end of nipple extending inside the manhole.
    - 2) Seal pipe nipple with a threaded ½ inch cap.
    - 3) Immediately before air testing, determine the ground water level by removing the threaded cap from the nipple, blowing air through the pipe nipple to remove any obstruction, and then connecting a clear plastic tube to the pipe nipple.
    - 4) Hold plastic tube vertically permitting water to rise in it to the groundwater level.
    - 5) After water level has stabilized in plastic tube, measure vertical height of water, in feet, above invert of sewer pipe.

- 6) Determine air pressure correction, which must be added to the 3.0 psig normal starting pressure of test, by dividing the vertical height in feet by 2.31. The result gives the air pressure correction in pounds per square inch to be added.

Example: if the vertical height of water from the sewer invert to the top of the water column measures 11.55 feet, the additional air pressure required would be:

$$\frac{(11.55)}{(2.31)} = 5.0 \text{ psig}$$

Therefore, the starting pressure of the test would be 3.0 plus 5 or 8.0 psig, and the ½ pound drop becomes 7.5 psig. There is no change in the allowable drop (0.5 psig) or in the time requirements established for the basic air test.

- B. After the line has passed the air test, it shall be balled and flushed with water to clean. A metal screen shall be used downstream at the point of connection to the existing system to collect and remove any rock or 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 sewer 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 Project Manager for review.
  - 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

**- END OF SECTION -**

**- SECTION 33 4000 -****STORM DRAINAGE**

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**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.
- B. Geotechnical Report:
  - 1. A geotechnical report is available and is titled "Geotechnical Investigation and Geologic Hazards Evaluation, College of San Mateo, Building 5N Modernization, 1700 W. Hillsdale Boulevard, San Mateo, California" prepared by Cornerstone Earth Group, dated February 1, 2008.

**1.2 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 31 2333 – Trenching, Backfilling, and Compacting.

**1.3 SUBMITTALS**

- A. Comply with provisions of Section 01 3219 – Submittal Procedures.

**1.4 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: Acrylonitrile-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 31 2333 – Trenching, Backfilling, and Compacting, 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 (¾ inch or greater opening between pipe sections).
    - c. Cocked joints present in straight runs or on the wrong side of pipe curves.

## STORM DRAINAGE



- 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.

**- END OF SECTION -**

