SPECIFICATIONS

COMMONS A/V
San Rafael High School

150 Third Street
San Rafael, California 94901

SAN RAFAEL CITY SCHOOLS
Bond Program
Building for Student Success

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SECTION 02 41 20
CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SECTION INCLUDES

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

1.2 SUBMITTALS

A. Submit written request in advance of cutting or alteration which affects:

1. Structural integrity of any element of Project.
2. Efficiency, maintenance, or safety of any operational element.
3. Visual qualities of sight-exposed elements.
4. Work of SRHS Commons or separate contractor.

B. Include in request:

1. Identification of Project.
2. Location and description of affected Work.
3. Necessity for cutting or alteration.
4. Description of proposed Work, and Products to be used.
5. Alternatives to cutting and patching.
6. Effect on Work of SRHS Commons or separate contractor.
7. Written permission of affected separate contractor.
8. Date and time Work will be executed.

1.3 DESIGN CRITERIA

A. Patching shall achieve security, strength, and weather protection, as applicable, and shall preserve continuity of existing fire ratings.

B. Patching shall successfully duplicate undisturbed adjacent finishes, colors, textures, and profiles. Where there is dispute as to whether duplication is successful or has been achieved to a reasonable degree, the Architect's judgment shall be final.

C. Patching may be temporary if it is to be eventually replaced in a subsequent phase of Work.

1.4 CUTTING AND PATCHING

A. Structural Work: Do not cut-and-patch structural Work in a manner resulting in a reduction of load-carrying capacity or load/deflection ration. Submit proposal and request and obtain Engineer's approval before proceeding with cut-and-patch of new and/or existing structural Work.

B. Operational/Safety Limitations: Do not cut-and-patch operational elements and safety components in a manner resulting in reduction of fire rating of any assembly, decreased performance, shortened useful life, or increased maintenance. The Contractor shall be responsible for the location of all existing utilities and coordinate all Work to avoid any interruption of service to adjacent properties and/or to other facility operations without proper notification.

C. Visual/Quality Limitations: Do not cut-and-patch Work exposed to view, such as plaster, in a manner resulting in noticeable reduction of visual qualities and similar qualities, as judged by Architect. (Exterior and interior).

D. Additional Requirements: In addition to Contract requirements, upon written instructions by Architect:

1. Uncover work to provide for Architect's observation of covered Work.

2. Remove samples of installed materials for testing.

E. Limitation on Approvals: Architect's and/or Engineer's approval to proceed with cutting-and-patching does not waive right to later require removal/replacement of Work found to be cut and patched in an unsatisfactory manner, as judged by Architect and Engineer.

1.5 PAYMENT FOR INCURRED COSTS

A. The costs caused by ill-timed or defective Work, or Work not conforming to Contract Documents, including costs for additional service of Architect and Engineer, shall be paid by the party responsible for ill-timed, rejected or non-conforming Work.

PART 2 - PRODUCTS

2.1 MATERIAL

A. Primary Products: Those required for original installation.

B. Substitutions: Under provisions of Division 01

C. Existing Materials: Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.

D. If identical materials are unavailable or cannot be used, use materials that visually match the original.

PART 3 - EXECUTION

3.1 GENERAL

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

1. Fit the several parts together, to integrate with other Work.

2. Uncover work to install ill-timed Work.

3. Remove and replace defective and non-conforming Work.

4. Remove samples of installed work for testing.

5. Provide openings in elements of Work for penetrations of mechanical/electrical Work.

3.2 EXAMINATION

A. Inspect existing conditions prior to commencing Work, including elements subject to damage or movement during cutting and patching. Verify compatibility with and suitability of substrates and finishes to accept the new Work.

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

C. Do not cut and patch any piping, conduit, or equipment supports or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.

D. Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in the Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

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

3.3 PREPARATION

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

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

C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. Existing Services: Where existing services are required to be removed, relocated, or abandoned, bypass such services before cutting to avoid interruption of services to occupied areas.

3.4 CUTTING AND PATCHING

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

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

C. Uncover work to install ill-timed Work.

D. Remove and replace defective or non-conforming Work.

E. Remove samples of installed Work for testing when requested.

F. Provide openings in the Work for penetration of mechanical and electrical Work where occurs.

G. Cut rigid materials using saw or drill. Pneumatic tools are not allowed without prior approval.

3.5 PERFORMANCE

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

B. Employ skilled and experienced installer to perform cutting and patching.

C. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

D. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

E. Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.

F. Restore work with new products in accordance with requirements of Contract Documents.

G. Fit Work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

H. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal all voids with fire-rated material, to full thickness of the penetrated element.

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

END OF SECTION

SECTION 05 43 00

SLOTTED CHANNEL FRAMING

PART 1 – GENERAL

1.01 SUMMARY

A. Framing shall be a strut type metal framing system (Strut System)

B. Strut System shall be used:

1. To support mechanical and electrical equipment and devices.
2. For structural appliances as applicable.

C. Strut System and components must be supplied from a single approved Manufacturer. UNISTRUT P5500 or Architect approved equal.

1.02 QUALITY ASSURANCE

A. Manufacturer's qualifications:
1. The manufacturer shall have at least 10 years experience in manufacturing Strut Systems.
2. The manufacturer must certify in writing all components supplied have been produced in accordance with an established quality assurance program.

B. Work shall meet the requirements of the following standards:
1. Federal, State and Local codes
2. American Iron and Steel Institute (AISI) Specification for the Design of Cold-Formed Steel Structural Members 2014 Edition.
3. American Society for Testing and Materials (ASTM)
4. Metal Framing Manufacturer's Association (MFMA)

1.03 SUBMITTALS

A. Structural calculations by a Registered Professional or Structural Engineer in the State of the Project's location for approval by the Professional of Record.
Calculations may include, but not limited to:
1. Description of design criteria
2. Stress and deflection analysis
3. Selection of framing members, fittings and accessories

B. Assembly drawings necessary to install the Strut System in compliance with the Contract drawings.

C. Pertinent manufacturers published data

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. All material is to be delivered to the work site in original factory packaging to avoid damage to the finish.

B. Upon delivery to the work site, all components shall be protected from the elements by a shelter or other covering.

1.05 WARRANTY

A. Manufacturer shall warrant for 1 year from the shipment date that products will be free from defects in material or manufacture. In the event of any such defect in violation of the warranty. Manufacturer shall have the option to repair or replace any such defective product.

B. Installer shall warrant for 1 year from the date of completion of work that the work will be free of defects in installation. In the event of any such defect in violation of the warranty, Installer shall have the option to repair or replace any such defective product.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Strut System and components shall be UNISTRUT.

2.02 MATERIALS

A. All channel members shall be fabricated conforming to one of the following ASTM specification:
1. Plain Carbon Steel : A 1011 SS Grade 33
2. Pre-Galvanized Carbon Steel: A 653 Grade 33
3. UNISTRUT DEFENDER . A 1046 SS Grade 33
4. Stainless Steel : A 240 (Type 304)
5. Aluminum: B 221 (Type 6063-T6)

B. All fittings shall be fabricated conforming to one of the following ASTM specifications:
1. Carbon Steel: All carbon steel fittings shall be fabricated from steel that meets/exceeds the physical requirements of ASTM A1011 SS Grade 33 and conforms to one of the following ASTM specifications:
   a. A 575
   b. A 576
   c. A 36
   d. A 635
   e. A 1059
   f. A 1046
2. Stainless Steel:
   a. A 240 (Type 304 or Type 316)
   b. A 276 (Type 304 or Type 316)
3. Aluminum:
   a. B 209 (Type 1100F or Type 5052-H32)

C. Any substitutions of product or manufacturer must be approved in writing ten days prior to bid by the Professional of Record.

2.03 FINISHES

A. FACTORY PAINTED
   1. Channel
      a. Rust inhibiting thermoset acrylic enamel paint applied by electro-deposition after cleaning and phosphating and thoroughly baked.
   2. Fittings
      a. Polyester powder coat after cleaning and phosphating and thoroughly baked.
   3. Color shall be FHWA Highway Green, Color Tolerance Chart, PR color No. 4
   4. Hardness = 2H
   5. Performance
      a. Salt Spray per ASTM B117
         1. Scribed: Exceed 400 hours
         2. Unscribed: Exceed 600 hours
      b. Nominal chalking at 1,000 hours per weatherometer G-23 test
      c. No checking at 1.000 hours per weatherometer G-23 test

B. ELECTRO-GALVANIZED per ASTM B 633 Type III SC 1

C. PRE-GALVANIZED per ASTM A653

   1. Zinc coated by hot-dipped process prior to roll forming at the steel mill
   2. Zinc coating thickness shall be G90 (0.75=0.45 oz/sq.ft surface area)

D. HOT-DIPPED GALVANIZED per ASTM A123 or A 153
   1. Zinc coated after all manufacturing operations are complete
   2. Zinc coating thickness shall be G65 (2.6 mils =1.50 oz.ft surface area)

E. UNISTRUT DEFENDER per ASTM A1046 and A1059
   1. Strut coated per A1046 to mass of 0.45 oz./sq.ft. surface area
   2. Fittings coated per A1059 to a thickness of 30 microns and/or A1046 to a mass of 0.45oz./sq/ft. surface area

F. SPECIAL COATING/MATERIAL
   (Describe as applicable)

PART 3- EXECUTION

3.01 EXAMINATION

A. The installer shall inspect the work area prior to installation. If work area conditions are unsatisfactory, installation shall not proceed until satisfactory corrections and completed.

3.02 INSTALLATION

A. Installation shall be accomplished by a fully trained manufacturer authorized installer.

B. Set Strut System components into final position true to line, level and plump, in accordance with approved drawings.

C. Anchor material firmly in place and tighten all connections to their recommended torques.

3.03 CLEANUP

A. Upon completion of this section of work, remove all protective wraps and debris. Repair

any damage due to installation of this section of work.

3.04 PROTECTION

A. During installation, it shall be the responsibility of the installer to protect this work from damage

B. Upon completion of this scope of work, it shall become the responsibility of the general contractor to protect this work from damage during the remainder of construction on the project and until substantial completion.

END OF SECTION

SECTION 05 50 00
METAL FABRICATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. All items of miscellaneous metal and related accessories and fasteners, including but not necessarily limited to the following:

1. Steel pipe railing, handrails, guardrails and brackets.

2. Continuous inserts for pipe and conduit supports.

3. Backing and mounting plates for equipment items.

4. Metal grating with frames and ledger angles.

5. Anchor bolts.

6. Auxiliary angles brackets.

1.2 REFERENCES

A. Published specifications, standards, tests, or recommended methods of trade, industry, or governmental organizations apply to Work of this Section where cited by abbreviations noted below (latest additions apply).

1. California Code of Regulations, Title 24, latest edition, also known as California Building Code (CBC), with 2001 amendments.

2. American Society for Testing and Materials (ASTM).

3. Federal Specifications (FS).

4. American Institute of Steel Construction's "Specification for Structural Steel Building".

5. American Welding Society's "Structural Welding Code" (AWS D1.1).

6. American Iron and Steel Institute's "Specifications for Design of Light Gauge Cold-Formed Stainless Steel Structural Members".

7. Steel Structures Painting Council's "Painting Manual":

a. Solvent Cleaning (SSPCC-SP 1).

b. Hand Tool Cleaning (SSPC-SP 2).

c. Brush-Off Blast Cleaning (SSPC-SP 7).

d. Hot Phosphate Surface treatment (SSPC-PT 4).

8. American Hot Dip Galvanizers Association, Inc. (AHDGA):

a. Inspection manual for hot dip galvanized products.

1.3 QUALITY ASSURANCE

A. Welded Qualifications: Welders shall be qualified in accordance with AWS D1.1.

B. Design Criteria:

1. Work shall be designed to support normally imposed loads and conform to AISC requirements.

2. Built-up parts shall not exhibit warp.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 33 00, Submittals.

B. Manufacturer's literature describing products including details and dimensions.

C. Shop Drawings:

1. Show a large scale construction of various parts, methods of joining, thickness of metals, profiles of surfaces, reinforcing, anchorage, and structural supports. Include information regarding concealed and exposed joints, welds, and fastenings.

2. Where welded connectors and concrete inserts are required to receive Work, show size and locations required.

D. Samples: Only as requested by the Architect.

1.5 DELIVERY, STORAGE AND HANDLING

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

B. Discharge materials carefully and store on clean concrete surface or raised platform in safe, dry area.

1.6 JOB CONDITIONS

A. Scheduling, Sequencing:

1. Ensure timely fabrication of items to be embedded or enclosed by other Work.

2. Furnish information and assistance required for locating embedded items and be responsible for proper locations.

PART 2 - GENERAL

2.1 BASIC MATERIALS AND ACCESSORIES

A. Ferrous Metals:

1. Structural Steel Shapes: ASTM A36, conforming to AISC specifications.

2. Architectural and Miscellaneous Steel Items: ASTM A283.

3. Steel Sheets: ASTM A570, Grade 36.

4. Steel Pipe: ASTM A53.

5. Steel Bars: ASTM A36.

6. Steel Tubing: ASTM A500, Grade B.

7. Steel Plate: ASTM A36.

8. Checker Plate: FS QQ-F461c, flat back carbon steel, pattern 15 or 16.

9. Zinc for Galvanizing: ASTM B06 as specified in ASTM A123.

10. Welding Electrodes: E-70XX.

11. Grout: Embeco "636" or approved equal.

12. Stair Treads: Irving, Reliance, or approved equal with abrasive metal nosing.

13. Grating: Irving, Reliance or approved equal typical one-inch X 3/16-inch beaming bars at 1-3/6-inch centers with 1/4-inch twisted cross bars welded at 4-inch centers, galvanized with bolted anchorage.

B. Fastenings:

1. Typical Unfinished Bolts, Nuts, and Washers: Low carbon steel standard fasteners, externally and internally threaded, ASTM A307 Grade A; malleable washers.

2. Expansion Bolts: FS FF-S-325, Group II, Type 4. Same as Hilti's "Kwik-Bolt II Concrete Anchors"; Wej-It Expansion Products, Inc.'s "Wej-It Concrete Anchors"; or approved equal.

C. Primer: Zinc-chromate type. Same as manufactured by Fuller-O'Brien Corp.'s Ne. 121-00; The Glidden Co.'s No. 4570; Sinclair Paint Co.'s 20; or approved equal.

2.2 SPECIALTY FABRICATED PRODUCTS

A. Preparation:

1. Coordinate with other Work supporting or adjoining miscellaneous metal and verify requirements of cutting out, fitting, and attaching.

2. Verify sizes, designs, and locations of items; do so at site whenever construction progress permits.

B. General Requirements:

1. Fabricate items from materials noted and make true to profiles shown. Obtain the Architect's approval of proposed variations.

2. Miter corners and angles of frames and moldings unless otherwise noted.

3. Perform cutting, shearing, drilling, punching, threading, tapping as required for items or their adjacent Work.

4. Drill or punch holes; do not use cutting torch.

5. Ensure shearing and punching leaves true lines and surfaces.

6. Items to be Galvanized: Fabricate in accordance with recommended practices of ASTM A385 and A386 unless specifically noted otherwise.

7. Fabricate exterior items for assembly and installation on site without field-welding of joint.

8. Ensure metal thickness and assembly details provide ample strength and stiffness.

9. Size sleeves for approximately 1/4-inch clearance all around.

C. Fastening:

1. Provide fasteners and anchor assemblies required for complete fabrication, field assembly, and erection.

2. Conceal fastenings wherever practicable.

3. Size internally threaded diameters to accommodate galvanized threaded bolts where galvanizing is required.

4. Permanent Connections in Ferrous Metal Items: Employ welding wherever practicable; avoid bolts and screws.

D. Welding:

1. Use electric shielded-arc process according to AWS D1.1.

2. Maintain shape and profile of item welded.

3. Prevent heat blisters, run-throughs, and surface distortions.

4. Welds Normally Exposed to View in Finished Work: Make uniform and grind smooth.

5. Exposed Welds: Remove burrs, flux, welding oxide, air spots and discoloration; grind smooth, polish, or otherwise finish to match material welded.

E. Bolted and Screwed Connections:

1. Use bolts for field connections only, and then only as noted. Countersink heads; finish smooth and flush.

   a. Provide washers under heads and nuts bearing on wood.

   b. Draw nuts tight and prevent loosening of permanent connections by nicking threads.

   c. Use beveled washers where bearing is on sloped surfaces.

2. Where necessary to use screws for permanent connections in ferrous metal, use flat head type, countersink, fill screw slots, and finish smooth and flush.

3. Evenly space exposed heads.

G. Ferrous Metal Pipe Railings:

1. Fabricate in largest sections practicable.

2. Weld shop joints; fit field joints with concealed pins and sleeves.

3. Flush fittings may be used for crosses and tees.

4. Return rails to wall as noted.

5. Close ends with welded cap and ease edges.

H. Handrail Bracket for Pipe Railings: Fabricate according to details on Drawings.

2.3 FINISHES

A. Preparations of Surfaces:

1. Thoroughly clean mill scale, rust, dirt, grease, and other foreign matter from ferrous metal prior to galvanizing, hot phosphate treatment or painting.

2. Where hand cleaning methods are not adequate, clean in accordance with SSPC-SP 1, SSPC-SP 2, or SSPC-SP 7 as required.

3. Completely eliminate burrs, rough spots and pitting from normally exposed ferrous metal items.

B. Galvanizing:

1. Galvanize items after fabrication in largest sections practicable unless otherwise permitted or recommended by ASTM A 384 and A385.

2. Where galvanizing is removed by welding or other assembly procedures, touch up abraded areas with molten zinc or zinc-rich paint.

3. Where ferrous metal item is noted to be galvanized, perform galvanizing in accordance with following standards as applicable to item:

a. Hardware items Including Fasteners: ASTM A153.

b. Items Both under 1/8-inch Thickness and Fabricated from Rolled, Pressed, and Forged Shapes, Plates, Bars, and Strips: ASTM A383.

c. Other Fabricated items: ASTM A123.

C. Finish Schedule: Unless noted otherwise in Materials or Standard Catalog Products Articles.

1. Ferrous Metal, Interior Items:

a. Concealed: Clean, chemically etch, and shop-apply one prime-coat.

b. Exposed: Clean, treat with hot phosphate, chemically etch, and shop-apply one prime-coat.

2. Special Ferrous Metal Items as Noted Below: Clean and hot-dip galvanize in accordance with galvanizing standards. Do not prime coat.

   a. Miscellaneous metal items such as stairs and railings.

3. Items Noted as Chrome-Plated: Same as US26D finish.

4. Hardware Including Fasteners (Bolts, Nuts, Washers, Etc.):

   a. Finish to match items fastened.

   b. Where galvanizing is required, hot-dip galvanize according to ASTM A153.

2.4 SOURCE QUALITY CONTROL

A. Tests and Inspections: The Owner will employ testing laboratory to test welds per CBC, Section 2212A.5.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas to receive Work and verify that setting conditions and dimensions are correct to receive items.

B. Do not start installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install Work plumb, true, rigid, and neatly trimmed out.

B. Do not tighten fastener through finish alone without spacer washers.

C. Provide concrete inserts or predrilled expansion bolts in fastening items into concrete.

D. Protect dissimilar metals from contact with each other or with other materials causing corrosion.

E. Fasten Work tightly to prevent rattle or vibration except where expansion-contraction tolerances are required.

F. Use nonshrink grout mixed in accordance with manufacturer's direction for setting frames, plates, sills, bolts and similar items.

G. Set items shown or required to be installed in sleeves with quicksetting anchor cement unless otherwise noted.

H. Protect metal from damage to surface, profile and shape.

3.3 CLEANING

A. Remove protective devices only when items will safe from other construction operations or removal is required to permit related Work.

B. Clean prime-coated items as required for finish painting.

END OF SECTION

SECTION 09 22 16
METAL STUD FRAMING SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Light-guage, non-structural, formed metal stud framing.

B. Framing accessories.

1.2 REFERENCES

A. ASTM A653 - Steel Sheet, Zinc- Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

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

C. ASTM C645 - Non-Load (Axial) Bearing Steel Studs, Runners (Track) and Rigid Furring Channels for Screw Application of Gypsum Board.

D. ASTM C754 - Installation of Steel Framing Members to Receive Screw-Attached Gypsum Wallboard, Backing Board, or Water-Resistant Backing Board.

E. ASTM C1002 - Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases.

F. NFPA 80 - Fire Doors and Windows.

G. GA600 - Fire Resistance Design Manual.

H. MSMA - Metal Stud Manufacturers Association.

I. SSPC - Steel Structures Painting Council.

1.3 SUBMITTALS

A. Submit under provisions of Section 01 33 00, Submittals.

B. Submit Shop Drawings of any prefabricated Work indicating component details, stud layout, framed openings, anchorage to structure, type and location of fasteners, and accessories or items required of other related work.

C. Product Data: Manufacturer’s descriptive literature for all products specified.

1.4 QUALITY ASSURANCE

A. Perform work in accordance with ASTM C754.

B. Maintain one copy of each document on site.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Gold Bond Building Products.

B. Domtar Gypsum.

C. National Gypsum Company.

D. Or approved equal. Substitutions under the provisions of Section 01 25 13, Product Options and Substitutions.

2.2 STUD FRAMING MATERIALS

A. Studs: ASTM A653, Grade 33, galvanized to G60 coating class in compliance with ASTM A924, non-load bearing rolled steel, channel shaped, punched for utility access, as follows:

1. Depth: 1-5/8, 2-1/2, 3-5/8, 4,and 6 inches - see drawings.

2. Thickness: 0.0179 inch unless otherwise indicated. 0.0329 inch where indicated.

B. Runners: Of same material, finish and thickness as studs, unpunched.

C. Ceiling Runners: Of same material, finish and thickness as studs.

D. Deflection and Firestop Track: Top runner designed to allow for deflection of structure applied to interior partition fabricated of same material, finish and thickness as studs and of the following configuration:

1. Top runner with slotted flanges, 2-1/2 inch deep with slots 1 inch on center.

2. Products: Subject to compliance with requirements provide one of the following:

a. “SLP-TRK”, Sliptrack Systems, Inc.

b. “The System”, Metal-Lite, Inc.

c. Or approved equal. Substitutions under the provisions of Section 01 25 13, Product Options and Substitutions.

E. Furring and Bracing Members: Of same material and finish as studs, thickness to suit purpose.

F. Fasteners: ASTM C1002, self-drilling, self-tapping screws.

G. Metal Backing: 0.0538 inch thick galvanized steel.

H. Anchorage Devices: Powder actuated.

I. Primer: SSPC 20.

2.3 FABRICATION

A. Fabricate assemblies of framed sections to sizes and profiles required; with framing members fitted, reinforced, and braced to suit design requirements.

B. Fit and assemble in largest practical sections for delivery to site, ready for installation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that conditions are ready to receive work.

B. Verify field measurements are as shown on Drawings.

C. Verify that rough-in utilities are in proper location.

D. Beginning of installation means installer accepts existing conditions.

3.2 ERECTION

A. Install components in accordance with ASTM C754 requirements and manufacturer's instructions.

B. Align and secure top and bottom runners at 24 inches on center.

C. Fit runners under and above openings; secure intermediate studs at spacing of wall studs.

D. Install studs vertically at 16 inches on center.

E. Connect studs to tracks using fastener method.

F. Stud splicing not permissible.

G. Construct corners using minimum three studs.

H. Double studs of 0.0329 inch thickness to form box jambs and headers at wall openings, door and window jambs, and each side of other openings.

I. Frame door and window openings with details indicated and with GA-600 and NFPA 80.

J. Install framing below sills of openings to match framing above head of opening.

K. Coordinate erection of studs with requirements of door and window frame supports and attachments.

L. Brace stud framing system and make rigid.

M. Construct toilet and plumbing chase walls of 0.0329 inch thick studs braced horizontally at 24 inches on center vertically with 2-1/2 inch wide cross studs.

N. Erect minimum 0.0329 inch thick studs behind all cementitious backing board and ceramic tile installations.

O. Align stud web openings and point stud flanges in the same directions.

P. Secure stud ends to bottom tracks on both faces.

Q. Coordinate installation of bucks, anchors, and backing with electrical and mechanical work to be placed in or behind stud framing.

R. Backing: Secure steel backing to studs. Install backing for support of toilet partitions, wall cabinets, toilet accessories, hardware, and all other wall mounted items.

S. Extend partition framing full height to structural support or substrates above suspended ceilings, except where partitions are indicated to terminate at ceiling.

T. For sound and fire resistance rated partitions extend framing to underside of floor/roof or other continuous solid surface to obtain rating.

U. Continue partition framing over door and window openings and frame around ducts penetrating partitions above ceiling.

V. Maintain clearance under structural building members to avoid deflection transfer to studs. Provide deflection track top runner to attain lateral support and avoid axial loading.

W. Coordinate placement of insulation in multiple stud spaces made inaccessible after stud framing erection.

X. Maintain clearance under structural building members at fire-resistance rated assemblies. Provide firestop track top runner.

3.3 ERECTION TOLERANCES

A. Maximum variation from true position: 1/2 inch.

B. Maximum variation of any member from plane: 1/8 inch in 10 feet.

C. Maximum variation from plumb: 1/8 inch in 10 feet.

END OF SECTION

SECTION 09 29 00
GYPSUM BOARD

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Gypsum board.

B. Taped and sanded joint treatment.

C. Surface primer.

D. Texture finish.

E. Resilient furring channels.

1.2 REFERENCES

A. ASTM C11 - Standard Terminology Relating to Gypsum and Related Building Materials and Systems.

B. ASTM C1396 - Gypsum Wallboard.

C. ASTM C475 - Joint Treatment Materials for Gypsum Wallboard Construction.

D. ASTM C514 - Nails for the Application of Gypsum Wallboard.

E. ASTM C557 - Adhesives for Fastening Gypsum Wallboard to Wood Framing.

F. ASTM C630 - Water Resistant Gypsum Backing Board.

G. ASTM C641 - Zinc-Coated (Galvanized) Carbon Steel Wire.

H. ASTM C645 - Non-Load (Axial) Bearing Steel Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board.

I. ASTM C754 - Installation of Steel Framing Members to Receive Screw Attached Gypsum Wallboard, Backing Board, or Water Resistant Backing Board.

J. ASTM C840 - Application and Finishing of Gypsum Board.

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

L. ASTM C1002 - Steel Drill Screws for the Application of Gypsum Board.

M. ASTM D226 - Asphalt-Saturated Felt Used in Roofing and Waterproofing.

N. ASTM E90 - Method for Laboratory Measurement of Airborne Sound transmission Loss of Building Partitions.

O. GA 201 - Using Gypsum Board for Walls and Ceilings.

P. GA 214 - Levels of Gypsum Board Finish.

Q. GA 216 - Application and Finishing of Gypsum Board.

R. GA 600 - Fire Resistance Design Manual.

S. CBC - California Building Code.

T. UL - Underwriters Laboratories.

1.3 QUALITY ASSURANCE

A. Applicator: Company specializing in gypsum board systems, with five years documented experience.

1.4 REGULATORY REQUIREMENTS

A. Conform to CBC, Chapter 7, and UL and GA requirements for fire-rated assemblies.

1.5 ACOUSTICAL PERFORMANCE

A. Acoustical attenuation for interior partitions, where indicated, shall be STC rating in accordance with ASTM E90.

1.6 DEFINITIONS

A. Refer to ASTM C11 for definitions of terms related to gypsum board assemblies.

1.7 FIELD SAMPLES

A. Provide field samples of finished surfaces under provisions of Section 01 33 00, Submittals.

B. On wall and ceiling surface duplicate specified texture finish on at least 100 square feet of surface area.

C. Provide complete finish including surface primer.

D. Simulate finished lighting conditions for review of field sample.

E. After surface texture is accepted, the accepted surface will remain as part of the Work and will be used to evaluate subsequent applications of finish texture.

1.8 SUBMITTALS

A. Submit under provisions of Section 01 33 00, Submittals.

B. Provide Product Data for all items specified.

C. CHPS Submittals:

1. Credit EQ2.0D.P1/ EQ2.2: Provide product data, MSDS, and other official literature from manufacturer clearly identifying that the product and its adhesives and sealants, meet the testing requirements and threshold limits of the State of California Department of Health Services (DHS) *Standard Practice for the Testing of Volatile Organic Compounds*. Such products shall be either identified on the *CHPS Low-Emitting Materials Product List* or by a 3rd party certification program listing low-emitting material products that meet the State testing requirements, as identified on the CHPS website.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Georgia Pacific Corp.

B. National Gypsum Company.

C. United States Gypsum Co..

D. Or approved equal. Substitutions under the provisions of Section 01 25 13, Product Options and Substitutions.

2.2 FRAMING MATERIALS

A. Metal Furring: ASTM C645, hat-shaped, 7/8 inch deep, .0329 inch thick.

B. Resilient Furring Channel: Manufacturer's standard product designed to reduce sound transmission, complying with ASTM C645 for material, finish and widths of face and fastening flange; 1/2 inch deep x .0179 inch thick asymmetric - shaped channel with face connected to single flange by slotted leg (web).

C. Furring Channel: ASTM C754, 1-1/2 inch x .475 pounds per foot.

D. Fasteners: ASTM C1002.

E. Hanger Wire: ASTM A641, Class 1 coating (galvanized) soft temper, 9 gauge.

F. Tie Wire: ASTM A641, Class 1 coating (galvanized) soft temper, 16 and 18 gauge.

G. Adhesive: ASTM C557.

2.3 GYPSUM BOARD MATERIALS

A. Standard Gypsum Board: ASTM C36; 5/8 inch thick unless otherwise indicated, maximum permissible length; ends square cut, tapered and beveled edges.

B. Fire Rated Gypsum Board: ASTM C36; fire resistive type, UL rated; 5/8 inch thick unless otherwise indicated, maximum permissible length; ends square cut, tapered and beveled edges.

C. Moisture-Resistant Gypsum Board: ASTM C630; 5/8 inch thick unless otherwise indicated, maximum permissible length; ends square cut, tapered and beveled edges.

2.4 ACCESSORIES

A. Acoustical Sealant: Non-hardening, non-skinning, for use in conjunction with gypsum board.

1. “Sheetrock Acoustical Sealant”, manufactured by United States Gypsum Company.

2. “BA-98 Acoustical Sealant”, manufactured by Pecora Corporation.

3. “Tremco Acoustical Sealant”, manufactured by Tremco, Inc.

B. Fire-Rated Sealant: As specified in Section 07 92 00, Joint Sealers.

C. Corner Beads: Metal, hot dip galvanized.

D. Edge Trim: GA 201 and GA 216; Type LC bead, unless otherwise indicated.

E. Control Joints: Roll-formed zinc, USG No. 093, or approved equal.

F. Spot Grout: ASTM C475, setting-type joint compound.

G. Joint Materials: ASTM C475; reinforcing tape, joint compound, adhesive, water, and fasteners. Use tapes and compound recommended by gypsum board manufacturer for the use intended. Use ready mixed, drying type compounds. Use taping compound for embedding tape and first coat over fasteners and flanges of corner beads and trim. Use topping compound for fill and finish coats.

H. Primer: Flat latex basecoat paint equivalent to “First Coat” manufactured by United States Gypsum Company.

I. Membrane: ASTM D226; No. 15 asphalt saturated roofing felt.

PART 3 - EXECUTION

3.1 INSPECTION

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

B. Beginning of installation means acceptance of substrate.

3.2 WALL FURRING INSTALLATION

A. Erect wall furring for direct attachment to concrete walls.

B. Erect metal furring vertically at [16] [24] inches on center. Secure in place on alternate channel flanges at maximum 24 inches on center.

3.3 ACOUSTICAL ACCESSORIES INSTALLATION

A. Space resilient furring channels horizontally at maximum 16 inches on center, not more than 2 inches from floor and ceiling lines.

B. Locate nested joints over framing members.

C. Install acoustical sealant within partitions in accordance with manufacturer's instructions and ASTM C919. Seal perimeter, joints, openings and penetrations on each face of partition.

3.4 GYPSUM BOARD INSTALLATION

A. Install gypsum board in accordance with ASTM C840 and manufacturer's instructions.

B. Erect single layer standard gypsum board in most economical direction, with ends and edges occurring over firm bearing except those ends and edges which are perpendicular to framing.

C. Erect single layer fire rated gypsum board vertically, with edges and ends occurring over firm bearing except those ends and edges which are perpendicular to framing members. Comply with required UL, CBC, or GA fire rated assembly.

D. Erect double layer gypsum board with standard gypsum board for first layer placed in most economical direction with second layer placed parallel to face layer with adhesive and supplementary fasteners. Off-set joints of second layer from joints of first layer by at least 12 inches.

E. Erect double layer fire-rated gypsum board in accordance with required UL, CBC, or GA fire rated assembly.

F. Use screws when fastening gypsum board to metal furring.

G. Use screws when fastening gypsum board to wood furring or framing except where nails are required for UL or CBC fire-rated assembly.

H. Install firestop sealant at wall penetrations and terminations in accordance with required UL, CBC, or GA fire-rated assembly in accordance with Section 07 84 00.

I. Treat cut edges and holes in moisture-resistant gypsum board with sealant.

J. Place control joints as indicated on the Drawings.

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

L. Spot grout metal door frames. Apply spot grout at each jamb anchor clip just before inserting board into frame.

3.5 JOINT TREATMENT

A. Tape, fill, and sand joints, edges, and corners in accordance with GA-214.

B. Feather successive coats a minimum of 2 inches onto adjoining surfaces for each coat.

C. Where fire-resistance rating is required, detail of joint treatment shall meet fire-rating requirement.

D. Level 1 Treatment:

1. All joints and angles shall have tape embedded in joint compound.

2. Surface shall be free of excess joint compound.

3. Tool marks and ridges are acceptable.

4. Use for plenum areas above ceiling, in areas that are generally concealed and other areas not normally open to view.

E. Level 2 Treatment:

1. All joints and angles shall have tape embedded in joint compound and one separate coat of joint compound shall be applied over all fastener heads and accessories.

2. Surface shall be free of excess joint compound.

3. Tool marks and ridges are acceptable.

4. Use where surface is substrate to ceramic tile, acoustic tile, or tackable wallboard system.

F. Level 3 Treatment:

1. Not used.

G. Level 4 Treatment:

1. All joints and angles shall have tape embedded in joint compound with three separate coats of topping compound applied over all joints, angles, fasteners, and accessories.

2. All compound shall be smooth and free of tool marks and ridges.

3. Sand lightly between coats, taking care not to roughen face paper.

4. Use for all surfaces that are scheduled to receive a textured and painted finish, except areas of food service and preparation, or a surface applied wallcovering.

H. Level 5 Treatment:

1. All joints and angles shall have tape embedded in joint compound with three separate coats of topping compound applied over all joints, fasteners, and accessories.

2. Apply a thin skim coat of topping compound over entire surface.

3. All compounds shall be smooth and free of tool marks and ridges.

4. Sand lightly between coats.

5. Use for food service and preparation areas and areas required in Paragraph 3.8.A below.

3.6 FINISHING

A. Roller apply surface primer to all gypsum board surfaces scheduled to receive a painted and textured finish prior to application of paint or texture finish.

B. Spray apply textured finish to all surfaces scheduled to receive a paint finish except surfaces of food service and preparation areas.

C. Trowel-apply patch-to-match textures to match existing.

D. Remove any overspray of texture finish from door frames, windows, and other adjoining construction.

3.7 TOLERANCES

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

3.8 SCHEDULE

A. New Construction: Note: New construction may be over wood or metal frame construction.

Room Type	Wallboard System	Finish Type	Notes
Typical Surfaces (Classrooms, corridors, office/work areas)	5/8", Type X	Level 5	All surfaces Accent surfaces only, such as Soffits.
Wet Areas	5/8", Type MR	Level 5 or coordinate with final surface	Coordinate finish with final surface treatment
Shaft Walls	Shaft wall system to suit	Finish outside per above, if exposed	

High Abuse Areas (Gymnasiums, workout areas, shops. main corridors)	5/8" High-Impact Fire-Shield 2000	Finish per above.	
Gang Restrooms (See 09310)			
Fire-Rated Underlayment	5/8" Type	Tape joints only	Use only in conjunction with a finish surface overlay system

END OF SECTION

SECTION 09 91 00
PAINTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Surface preparation.

B. Products and application.

C. Surface finish schedule.

D. Patch to match existing.

1.2 REFERENCES

A. ASTM D16 - Definitions of Terms Relating to Paint, Varnish, Lacquer, and Related Products.

B. ASTM D2016 - Test Method for Moisture Content of Wood.

1.3 SYSTEM DESCRIPTION

A. Preparation of all surfaces to receive final finish.

B. Painting and finishing Work of this Section using coating systems of materials including primers, sealers, fillers, and other applied materials whether used as prime, intermediate, or finish coats.

C. Surface preparation, priming, and finish coats specified in this Section are in addition to shop-priming and surface treatment specified under other Sections.

D. Painting and finishing all exterior and interior surfaces of materials including structural, mechanical, and electrical Work on site, in building spaces, and above or on the roof.

E. Paint exposed surfaces except where a surface or material is specifically indicated not to be painted or is to remain natural. Where an item or surface is not specifically mentioned, paint the same as similar adjacent materials or surfaces.

1.4 DEFINITIONS

A. Conform to ASTM D16 for interpretation of terms used in this Section.

1.5 QUALITY ASSURANCE

A. Product Manufacturer: Company specializing in manufacturing quality paint and finish products with five years experience.

B. Applicator: Company specializing in commercial painting and finishing with five years documented experience.

C. Regulatory Requirements: Comply with applicable codes and regulations of governmental agencies having jurisdiction including those having jurisdiction over airborne emissions and industrial waste disposal. Where those requirements conflict with this specification, comply with the more stringent provisions. Comply with the current applicable regulations of the California Air Resources Board (CARB) and the Environmental Protection Agency (EPA).

D. Coats: The number of coats specified is the minimum number acceptable. If full coverage is not obtained with the specified number of coats, apply such additional coats as are necessary to produce the required finish.

E. Employ coats and undercoats for all types of finishes in strict accordance with the recommendations of the paint manufacturer.

F. Provide primers and undercoat paint produced by the same manufacturer as the finish coat.

1.6 SUBMITTALS

A. Submit under provisions of Section 01 33 00, Submittals.

B. Provide manufacturer's technical information and instructions for application of each material proposed for use by catalog number.

C. List each material by catalog number and cross-reference specific coating with specified finish system.

D. Provide manufacturer's certification that products proposed meet or exceed specified materials.

E. Submit two 8-1/2 inch x 11 inch samples of each paint color and texture applied to cardboard. Resubmit samples until acceptable color, sheen and texture is obtained.

F. On same species and quality of wood to be installed, submit two 4 x 8 inch Samples showing system to be used.

G. Provide product data, MSDS, and other official literature from manufacturer identifying that the INTERIOR APPLIED products meet the testing requirements and threshold limits of the State of California Department of Health Services (DHS) *Standard Practice for the Testing of Volatile Organic Compounds*. Such products shall be identified by a 3rd party certification program listing low-emitting material products. Contractor to clearly highlight, circle and call out on the product literature, identifying how the product complies.

1.7 FIELD SAMPLES

A. Provide field samples under provisions of Section 01 33 00, Submittals.

B. On wall surfaces and other exterior and interior components, duplicate specified finishes on at least 100 square feet of surface area.

C. Provide full-coat finishes until required coverage, sheen, color and texture are obtained.

D. Simulate finished lighting conditions for review of field samples.

E. After finishes are accepted, the accepted surface may remain as part of the Work and will be used to evaluate subsequent coating systems applications of a similar nature.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver the products to site and store and protect under provisions of Section 01 66 00, Product Delivery, Storage, and Handling.

B. Deliver products to site in sealed and labeled containers; inspect to verify acceptance.

C. Container labeling to include manufacturer’s name, type of paint, brand name, brand code, coverage, surface preparation, drying time, cleanup, color designation, and instructions for mixing and reducing. Paint containers not displaying product identification will not be acceptable.

D. Store paint materials at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in well ventilated area, unless required otherwise by manufacturer’s instructions.

E. Take precautionary measures to prevent fire hazards and spontaneous combustion.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Provide continuous ventilation and heating facilities to maintain surface and ambient temperatures above 45 degrees F for 24 hours before, during, and 48 hours after application of finishes, unless required otherwise by manufacturer's instructions.

B. Do not apply exterior coatings during rain or snow, or when relative humidity is above 50 percent, unless required otherwise by manufacturer's instructions.

C. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

D. Minimum Application Temperature for Varnish and Urethane Finishes: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 feet candles measured mid-height at substrate surface.

1.10 EXTRA STOCK

A. Provide a ten gallon container of each finish paint color to Owner for touchup.

B. Label each container with color, texture, and room locations in addition to the manufacturer's label.

1.11 QUALITY ASSURANCE

A. Product Manufacturer: Company specializing in manufacturing quality paint and finish products with five years experience.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Unless specifically identified otherwise, product designations are those of the Kelly-Moore Paint Company and shall serve as the standard for kind, quality, and function.

B. Subject to compliance with requirements, other manufacturers offering equivalent products are:

1. Benjamin Moore Paints.

2. Frazee Paint (McCloskey, Ameron).

3. ICI Paint Stores.

4. Dunn-Edwards Corporation.

5. Pittsburgh Paints.

6. Sherwin Williams.

7. Spectra-Tone Paint Corp.

8. Tnemec Company, Inc.

9. Vista Paint Corporation.

C. Substitutions: Under provisions of Section 01 25 13, Product Options and Substitutions.

2.2 MATERIALS

A. Ready mixed, except field catalyzed coatings. Process pigments to a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating.

B. Good flow and brushing properties; capable of drying or curing free of streaks or sags.

C. Accessory Materials: Linseed oil, shella, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified, of commercial quality.

D. INTERIOR APPLIED Paint shall be low-emitting and must meet the testing requirements and threshold limits of the State of California Department of Health Services (DHS) *Standard Practice for the Testing of Volatile Organic Compounds*. Such products shall be identified by a 3rd party certification program listing low-emitting material.

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2.3 FINISHES

A. Refer to schedule at end of Section for surface finish schedule.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify that surfaces are ready to receive Work as instructed by the product manufacturer.

B. Examine surfaces to be finished prior to commencement of Work. Report any condition that may potentially affect proper application.

C. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:

1. Plaster and Gypsum Wallboard: 12 percent.

2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.

3. Interior Located Wood: 15 percent, measured in accordance with ASTM D2016.

4. Exterior Located Wood: 15 percent, measured in accordance with ASTM D2016.

D. Beginning of installation means acceptance of existing surfaces.

3.2 SURFACE PREPARATION

A. Remove electrical plates, hardware, light fixture trim, and fittings prior to preparing surfaces or finishing.

B. Correct minor defects and clean surfaces which affect Work of this Section.

C. Shellac and seal marks which may bleed through surface finishes.

D. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

E. Aluminum Surfaces: Remove surface contamination by steam or high pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.

F. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.

G. Concrete Floors: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.

H. Gypsum Board: Repair all voids, nicks, cracks and dents with patching materials and finish flush with adjacent surface. Latex fill minor defects. Spot prime defects after repair.

I. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Pretreat with phosphoric acid etch or vinyl wash. Apply coat of etching primer the same day as pretreatment is applied.

J. Concrete and Unit Masonry: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

K. Plaster: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

L. Uncoated Steel and Iron: Remove grease, scale, dirt, and rust. Where heavy coatings of scale are evident, remove by wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Spot prime paint after repairs.

M. Shop Primed Steel: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.

N. Interior Wood: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats.

O. Exterior Wood: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior caulking compound after prime coat has been applied.

P. Glue-Laminated Beams: Prior to finishing, wash surfaces with solvent, remove grease and dirt.

Q. Wood Doors: Seal top and bottom edges with 2 coats of spar varnish sealer.

3.3 PROTECTION OF ADJACENT WORK

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

B. Repair damage to other surfaces caused by Work of this Section.

C. Furnish drop cloths, shields, and protective methods to prevent spray or droppings from disfiguring other surfaces.

D. Remove empty paint containers from site.

3.4 WORK NOT TO BE PAINTED

A. Painting is not required on surfaces in concealed and inaccessible areas such as furred spaces, foundation spaces, utility tunnels, pipe spaces and duct shafts.

B. Do not paint metal surfaces such as stainless steel, chromium plate, brass, bronze, and similar finished metal surfaces.

C. Do not paint anodized aluminum or other surfaces which are specified to be factory pre-finished.

D. Do not paint sandblasted or architecturally finished concrete surfaces.

E. Do not paint over Underwriters Laboratories, Factory Mutual or other code-required labels or identifications.

3.5 APPLICATION

A. Apply products in accordance with manufacturer's instructions.

B. Do not apply finishes to surfaces that are not dry.

C. Apply each coat to uniform finish.

D. Apply each coat of paint slightly darker than preceding coat unless otherwise approved.

E. Sand lightly between coats to achieve required finish.

F. Allow applied coat to dry before next coat is applied.

G. The number of coats specified is the minimum that shall be applied. Apply additional coats when undercoats, stains or other conditions show through final paint coat, until paint film is of uniform finish, color and appearance.

H. Where clear finishes are required, tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

I. Prime back surfaces of interior and exterior woodwork with primer paint.

J. Prime back surfaces of interior woodwork scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with mineral spirits.

K. Paint mill finished door seals to match door or frame.

L. Paint primed steel glazing stops in doors to match door or frame.

M. Cloudiness, spotting, lap marks, brush marks, runs, sags, spikes and other surface imperfections will not be acceptable.

N. Where spray application is used, apply each coat of the required thickness. Do not double back to build up film thickness of two coats in one pass.

O. Where roller application is used, roll and redistribute paint to an even and fine texture. Leave no evidence of roller laps, irregularity of texture, skid marks, or other surface imperfections.

P. For painting of exterior patchwork, paint to the nearest surface break.

3.6 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

A. Paint shop primed equipment. Do not paint shop prefinished items.

B. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

C. Prime and paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, except where items are prefinished.

D. Replace identification markings on mechanical or electrical equipment when painted accidentally.

E. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.

F. Replace electrical plates, hardware, light fixture trim, and fittings removed prior to finishing.

G. Paint grilles, registers, and diffusers which do not match color of adjacent surface.

H. Paint all mechanical and electrical equipment, vents, fans, and the like occurring on roof.

I. Do not paint moving parts of operating units; mechanical or electrical parts such as valve operators; linkages; sensing devices; and motor shafts.

J. Do not paint over labels or equipment identification markings.

K. Do not paint mechanical room specialties such as compressors, boilers, pumps, control panels, etc.

L. Do not paint switch plates, light fixtures, and fixture lenses.

3.7 CLEANING

A. As Work proceeds, promptly remove paint where spilled, splashed, or spattered.

B. During progress of Work maintain premises free of unnecessary accumulation of tools, equipment, surplus materials, and debris.

C. Collect cotton waste, cloths, and material which may constitute a fire hazard, place in closed metal containers and remove daily from site.

3.8 PROTECTION OF COMPLETED WORK

A. Protect finished installation.

B. Erect barriers and post warning signs. Maintain in place until coatings are fully dry.

C. Confirm that no dust generating activities will occur following application of coatings.

3.9 PATCHING

A. After completion of painting in any one room or area, repair surfaces damaged by other trades.

B. Touch-up or re-finish as required to produce intended appearance.

3.10 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 01 45 00, Quality Control.

B. The Owner reserves the right to invoke the following test procedure at any time and as often as the Owner deems necessary.

C. The Owner will engage the services of an independent testing agency to sample paint material being used.

D. Samples of material delivered to the Project will be taken, identified, sealed, and certified in the presence of the Contractor.

E. The testing agency will perform appropriate quantitive materials analysis and other characteristic testing of materials as required by the Owner.

F. If test results show materials being used and their installation do not comply with specified requirements or manufacturer's recommendations, the Contractor may be directed to stop painting, remove noncomplying paint, pay for testing and repaint surfaces to acceptable condition.

3.11 COLOR SCHEDULE

A. Paint and finish colors shall be custom color, mixed and formulated to meet color as specified by Architect.

B. Interior Colors: 10 interior paint colors to be selected and located by Architect.

C. Exterior Colors: 4 exterior paint colors to be selected and located by Architect.

D. Access doors, registers, exposed piping, electrical conduit and mechanical/electrical panels if not stainless steel; generally the same color as adjacent walls.

E. Exterior and interior steel doors, frames and trim; match adjacent existing door frames.

F. Doors: Match adjacent existing door paint or varnish.

G. Interior and Exterior Steel Fabrications, if not Stainless Steel: Match existing or adjacent walls.

3.12 SCHEDULE - EXTERIOR SURFACES

A. The following Kelly Moore paint systems or Architect approved equal shall be used:

1. Wood-Painted (Flat Acrylic) - Exterior Trim and Exposed Wood Framing

1st coat:	KM 255 AcryShield wood Primer
2nd coat:	KM 1200 Premium professional 100% Acrylic Flat
3rd coat:	KM 1200 Premium professional 100% Acrylic Flat

2. Wood-Painted (Semi-Gloss Acrylic)

1st coat:	KM 255 AcryShield wood Primer
2nd coat:	KM 1215 Premium Professional 100% Acrylic S/G
3rd coat:	KM 1215 Premium Professional 100% Acrylic S/G

3. Wood-Painted (Gloss Alkyd)

1st coat:	KM 265 Water-Alkyd Professional Primer
2nd coat:	KM 1980 Professional Waterborne Urethane Modified Alkyd Gloss
3rd coat:	KM 1980 Professional Waterborne Urethane Modified Alkyd Gloss

4. Wood - Semi-Transparent

1st coat:	Storm System 2

5. Concrete (Flat Acrylic) - Exposed concrete indicated on drawings to be painted

1st coat:	KM 255 AcryShield Masonry Primer
2nd coat:	KM 1200 Premium Professional 100% Acrylic Flat
3rd coat:	KM 1200 Premium Professional 100% Acrylic Flat

6. Concrete Masonry Units (Flat Acrylic)

Fill coat:	KM 521 Color Shield Prime and Fill
1st coat:	KM 1200 Premium professional 100% Acrylic Flat
2nd coat:	KM 1200 Premium professional 100% Acrylic Flat

7. Cement Plaster (Flat Elastomeric)

1st coat:	KM 98 Multi-Seal
2nd coat:	KM 1128 Kel-Seal
3rd coat:	KM 1128 Kel-Seal

8. Steel-Primed or Unprimed (Flat Acrylic)

1st coat:	Rust-Oleum CV740 Primer
2nd coat:	KM 1200 Premium professional 100% Acrylic Flat
3rd coat:	KM 1200 Premium professional 100% Acrylic Flat

9. Steel-Primed or Unprimed (Semi-Gloss Acrylic)

1st coat:	Rust-Oleum CV740 Primer
2nd coat:	KM 1215 Premium Professional 100% Acrylic S/G

3rd coat:	KM 1215 Premium Professional 100% Acrylic S/G

10. Steel-Primed or Unprimed (Gloss-Alkyd)

1st coat:	KM 265 Water-Alkyd Professional Primer
2nd coat:	KM 1980 Professional Waterborne Urethane Modified Alkyd Gloss
3rd coat:	KM 1980 Professional Waterborne Urethane Modified Alkyd Gloss

11. Steel-Galvanized (Flat Acrylic)

1st coat:	Krud Kutter Metal and Etch
2nd coat:	KM 5725 DTM Primer
3rd coat:	KM 1200 Premium Professional 100% Acrylic Flat
4th coat	KM 1200 Premium Professional 100% Acrylic Flat

12. Steel-Galvanized (Semi-Gloss - Acrylic)

Prep:	Krud Kutter Metal and Etch
1st coat:	KM 5725 DTM Primer
2nd coat:	KM 1215 Premium Professional 100% Acrylic S/G
3rd coat	KM 1215 Premium Professional 100% Acrylic S/G

13. Steel-Galvanized (Gloss - Alkyd)

Prep:	Krud Kutter Metal and Etch
1st coat:	KM 5725 DTM Primer
2nd coat:	KM 1980 Professional Waterborne Urethane Modified Alkyd Gloss
3rd coat	KM 1980 Professional Waterborne Urethane Modified Alkyd Gloss

14. Pavement Marking –Refer to Section 32 12 16 & Section 32 13 13 KM 1272 Zone Marking

3.13 SCHEDULE - INTERIOR SURFACES

A. The following Dunn-Edwards paint systems or Architect approved equal shall be used:

1. Wood-Painted (Semi-Gloss Alkyd) - Wood Trim

1st coat:	KM 265 Water-Alkyd Professional Primer
2nd coat:	KM 1930 Professional Waterborne Urethane Modified Alkyd S/G
3rd coat:	KM 1980 KM Professional Waterborne Urethane Modified Alkyd S/G

2. Wood-Painted (Gloss Alkyd)

1st coat:	KM 265 Water-Alkyd Professional Primer
2nd coat:	KM 1980 Professional Waterborne Urethane Modified Alkyd Gloss
3rd coat:	KM 1980 Professional Waterborne Urethane Modified Alkyd Gloss

4. Wood - Transparent (Stain - Semi-Gloss Varnish)

1st coat:	Old Masters Master Armor
Filler coat (Open grain wood only):	Old Masters Wood Filler
2nd coat:	Old Masters Master Armor
3rd coat:	Old Masters Master Armor

5. Wood - Transparent (Stain-Semi-Gloss Lacquer)

1st coat:	Old Masters Wiping Stain
2nd coat:	Old Masters Master Armor
3rd coat:	Old Masters Master Armor
4th coat:	Old Masters Master Armor

6. Concrete (Flat-Latex)

1st coat:	KM 247 AcryShield Masonry Primer
2nd coat:	KM 1005 Premium Professional Flat
3rd coat:	KM 1005 Premium Professional Flat

7. Concrete (Semi Gloss Latex)

1st coat:	KM 247 AcryShield Masonry Primer
2nd coat:	KM 1050 Premium Professional S/G
3rd coat:	KM 1050 Premium Professional S/G

8. Concrete Floors - Sealed (Low Sheen Epoxy Acrylic)

1st coat:	AllFlor 530XX
2nd coat:	AllFlor 530XX

12. Steel - Primed or Unprimed (Flat-Latex) - Exposed Duct Work

1st coat: KM 5725 DTM Primer/Finish

2nd coat: KM 5725 DTM Primer/Finish

3rd coat: KM 5725 DTM Primer/Finish

13. Steel - Primed or Unprimed (Semi-Gloss-Alkyd) - Steel Doors/Frames

1st coat: KM 265 Water-Alkyd Professional Primer

2nd coat: KM 1930 Professional Waterborne Urethane Modified Alkyd S/G

3rd coat: KM 1930 Professional Waterborne Urethane Modified Alkyd S/G

14. Steel - Primed or Unprimed (Gloss-Alkyd)

1st coat: KM 265 Water-Alkyd Professional Primer

2nd coat: KM 1980 Professional Waterborne Urethane Modified Alkyd Gloss

3rd coat: KM 1980 Professional Waterborne Urethane Modified Alkyd Gloss

15. Steel - Galvanized (Flat-Latex) - Exposed Duct Work

1st coat: KM 5725 DTM Primer/Finish

2nd coat: KM 5725 DTM Primer/Finish

3rd coat: KM 5725 DTM Primer/Finish

16. Steel - Galvanized (Semi-Gloss - Alkyd) - Steel Handrails

1st coat: KM 5725 DTM Primer

2nd coat: KM 1930 Professional Waterborne Urethane Modified Alkyd S/G

3rd coat: KM 1930 Professional Waterborne Urethane Modified Alkyd S/G

17. Steel - Galvanized (Gloss - Alkyd)

1st coat: KM 5725 DTM Primer

2nd coat: KM 1980 Professional Waterborne Urethane Modified Alkyd Gloss

3rd coat: KM 1980 Professional Waterborne Urethane Modified Alkyd Gloss

18. Gypsum Board (Flat - Latex)

1st coat: KM 971 AcryPlex PVA/Sealer

2nd coat: KM 1005 Premium Professional Flat

3rd coat: KM 1005 Premium Professional Flat

19. Gypsum Board (Eggshell-Acrylic) - Gypsum Board Walls and Ceilings

1st coat:	KM 971 AcryPlex PVA/Sealer
2nd coat:	KM 1010 Premium Professional Eggshell
3rd coat:	KM 1010 Premium Professional Eggshell

20. Gypsum Board (Semi-Gloss -Acrylic) - Kitchen areas; all Interior Wood Trim

1st coat:	KM 971 AcryPlex PVA/Sealer
2nd coat:	KM 1685 Dura-Poxy S/G
3rd coat:	KM 1685 Dura-Poxy S/G

21. Gypsum Board (Gloss -Acrylic)

1st coat:	KM 971 AcryPlex PVA/Sealer
2nd coat:	KM 1680 Dura-Poxy Gloss
3rd coat:	KM 1680 Dura-Poxy Gloss

22. Gypsum Board (Gloss -Epoxy)

1st coat:	KM Tru-Glaze 4030 Epoxy Primer
2nd coat:	KM Tru-Glaze 4428 WB Epoxy Gloss
3rd coat:	KM Tru-Glaze 4428 WB Epoxy Gloss

END OF SECTION

SECTION 26 01 00
BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The requirements of the General Conditions and Division 1, General Requirements, apply to the work specified in this section.

1.2 DESCRIPTION OF WORK

A. Related Work in Other Sections, but not limited to the following:

1. Motors, motor controls and low voltage control wiring that are an integral part of equipment assemblies and heating and ventilation controls.

2. Painting of exposed electrical work.

3. Data network and distribution.

B. Work Included in Contract

1. Provide and install new 120/208V, 3 phase, 4 wire electrical distribution system as detailed on drawings.

2. Grounding and bonding per NEC.

3. Provide conduits for audio/visual system as shown on drawings and specified under Division 27.

4. Provide wiring and hookup of all electrical equipment specified under other specification sections, such as technology systems, mechanical and plumbing equipment.

5. Provide interconnection from AV system to the existing Notifier NFS2-3030 fire alarm system to silence AV system upon activation of fire alarm system.

1.3 CODES AND STANDARDS

A. In addition to Codes and Standards - Division 1, the following shall apply to this Division:

National Electrical Code with California amendments
California Admin. Code, Titles 17, 19, 24, Part 3.
U.L. Electrical Construction Materials List
Codes, rules and regulations as specified hereinafter
Local city and county agencies

1.4 SUBMITTALS

A. Submittals shall be made in conformance with the General Conditions. The list shall include, for each item, the manufacturer, manufacturer's catalog number, type of class, the rating, capacity, size, etc. Submittals shall include:

1. Conduit & Fittings
2. Boxes & Covers
3. Fuses
4. Wire & Cable
5. Wiring Devices
6. Disconnect Switches
7. Telephone/Data Networking System
8. Fire Alarm System

B. Shop Drawings: Submit for approval, detailed construction drawings for each item of fabricated equipment required for the electrical installation. All drawings shall be to scale, fully dimensioned, and provide sufficient detail to clearly indicate the arrangement of the equipment and its component parts. Construction of the equipment shown shall be revised to comply with the drawings and specifications as required by the Architect after review of the shop drawings, and the drawings submitted when requested by the Architect. Shop drawings shall be submitted for the following:

1. Telephone/Data Networking System
2. Fire Alarm System

C. Substitution: Provide substitutions as outlined.

1.5 SUPERVISION OF ELECTRICAL WORK

A. Contractor shall personally, or through an authorized and competent representative, constantly supervise the work from beginning to completion and final acceptance. So far as possible, keep same foreman and workmen throughout the project duration. Work shall be subject to inspection and approval by Architect. Promptly furnish related information when so requested by Architect.

1.6 EQUIPMENT AND SYSTEMS IDENTIFICATION

A. Name Plates: Provide permanent identification of circuit breakers in switchboards, panels, transformers, disconnects for mechanical and plumbing roof-top equipment and other cabinet enclosed apparatus. Use black bakelite plates, not less than ½" X 3", with engraved white letters, secured with adhesive. Provide voltage along with panel name. Provide red with white letters on FACP, FATC, etc.

B. Stencil Work: Identify all motors and operating apparatus in electrical equipment rooms or semi-concealed spaces, with black or white lacquer lettering, not less than ½" high, placed where readily visible upon inspection.

C. Directories: Provide for power circuits, typewritten, neatly arranged in numerical order, and permanently fixed inside or adjacent to appropriate panel.

D. Provide lamecoid label on all receptacle and switch covers indicating complete circuit number.

E. Provide service description etched on cover of all underground pull boxes.

F. Provide lamecoid label on all receptacle and switch covers indicating complete circuit number.

G. Provide lamecoid label on all blank cover plates indicating circuit number or low voltage system (i.e. future data, intrusion, etc.).

H. Provide lamecoid label on all fire alarm device covers indicating complete device number.

1.7 OPERATING INSTRUCTIONS ON-SITE

A. At time of occupancy, arrange for manufacturer's representatives to instruct building operating and maintenance personnel in use of any equipment requiring operating and maintenance. Arrange for all personnel to be instructed at one time. Pay all costs for such service (minimum of 4 hours).

1.8 ADJACENT WORK

A. Coordinate work and complete with others in furnishing and placing this work.

B. Work to approved shop drawings for work by others and to field measurements as necessary to properly fit the work.

C. Project adjacent work as necessary; adjacent construction or exposed surfaces or surfaces damaged by use of materials or operations under this Section shall be repaired or replaced as directed by Architect.

1.9 DRAWINGS

A. The electrical drawings, which constitute an integral part of this contract, shall serve as the working drawings. They indicate diagrammatically the general layout of the

complete electrical system, including the arrangement of feeders, circuits, panelboards, service equipment, and other work. Field verifications of scale dimensions taken from the drawings are directed since actual field locations, distances and elevations will be governed by actual field conditions. Review architectural, structural, mechanical and plumbing drawings and adjust work to conform to all conditions indicated thereon. Discrepancies shown on different plans or between plans and actual field conditions, or between plans and specifications, shall promptly be brought to the attention of the Architect for a decision.

1.10 COORDINATION AND COOPERATION

A. Drawings and specifications are both supplementary and complementary. Taken together, they are intended to define complete working installations of the systems represented, in accordance with approved practice in the trade, and in conformity with all applicable requirements of local jurisdictional offices and officers and codes and enforcing bodies.

B. It shall be presumed that any bid offered under this Division of the Specifications is based on a careful examination of the job site, and of the plans and specifications; that the person(s) or firm(s) awarded a contract hereunder is/are experienced and qualified in the type of work represented; that every effort has been made to prepare complete, accurate and correct plans and specifications; and that reasonable diligence will be exercised in planning and scheduling the work to anticipate conflicts and/or detect errors or omissions. All such shall be immediately reported, and proper resolution agreed on between concerned parties before the work affected is performed. If due to lack of diligence, or to incompetence, failure to anticipate such problems shall not create a valid claim for extra costs or charges.

C. Requirements of other trades, of utility companies, and of fire departments, protective services, communication systems, or other facilities of a utility nature, shall be determined prior to installation of systems, equipment, devices or materials affected by or dependent on such requirements.

D. Unapproved deviations or changes based on a presumption of error or code violation, or work not suitable for its intended function, may not be accepted.

E. Nothing herein shall act to prevent or discourage the contractor from suggesting or discussing possible changes in the work where such might be beneficial to the contractor or the owner, or might facilitate the work of this or other trades.

F. Any work resulting in a claim for a change in the contract price must be approved and fully documented.

1.11 VISIT TO SITE

A. Visit the project site, take requisite measurements, and verify exact location of buildings, utilities, and other facilities, and obtain such other information as is necessary for an

intelligent bid. No allowance will subsequently be made by the Architect or Owner for any error or omission on the part of the bidder in this connection.

1.12 RECORD DRAWINGS

A. Record of Job Progress: Keep an accurate dimensional record of the "as-built" locations and of all work; all as required. This record shall be kept up-to-date on blueline prints as the job progresses and shall be available for inspection at all times. It shall be reviewed by inspector prior to each monthly application for payment.

B. Record of Installation: Refer to Supplementary General Conditions.

C. Include on "as-built" drawings:

1. Routing of all buried or concealed electrical feeders and conduits.

D. Upon completion of the work, a completed set of as-built reproducible vellums and electronic file (ACAD 2004) on Cd/DVD disk(s) shall be delivered to the Architect.

1.13 GUARANTEE

A. All work shall be guaranteed for a minimum period of one year from either the official date of completion or from the date of acceptance by the Owner, whichever is the later date. The guarantee period for certain items shall be longer, as indicated in the specification for those items.

B. Should any trouble develop during the guarantee time due to defective material, faulty workmanship, or non-compliance with plans, specifications, codes or directions of the Owner, Architect, Engineer or Inspector, the Contractor shall furnish all necessary labor and materials to correct the trouble without additional charges.

1.14 COMMISSIONING

A. Electrical systems including lighting and lighting controls, occupancy sensors, daylight controls, switching systems, exterior lighting controls and uninterruptible power supplies will be commissioned per the requirements specified in Commissioning Requirements."

END OF SECTION

SECTION 26 05 00
BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Electrical identification.

2. Concrete equipment bases.

3. Electrical demolition.

4. Cutting and patching for electrical construction.

1.2 SUBMITTALS

A. Product Data: For utility company electricity-metering components.

B. Shop Drawings: Dimensioned plans and sections or elevation layouts and single-line diagram of electricity-metering component assemblies specific to this Project.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

1.4 COORDINATION

A. Coordinate chases, slots, inserts, sleeves, and openings for electrical supports, raceways, and cable with general construction work.

B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment that requires positioning before closing in the building.

C. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces.

D. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.

PART 2 - PRODUCTS

2.1 SUPPORTING DEVICES

A. Material: Cold-formed steel, with corrosion-resistant coating.

B. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.

C. Slotted-Steel Channel: Flange edges turned toward web, and 9/16-inch- diameter slotted holes at a maximum of 2 inches o.c., in webs. Strength rating to suit structural loading.

D. Slotted Channel Fittings and Accessories: Recommended by the manufacturer for use with the type and size of channel with which used.

1. Materials: Same as channels and angles, except metal items may be stainless steel.

E. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.

F. Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.

G. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for nonarmored electrical cables in riser conduits. Plugs have number and size of conductor gripping holes as required to suit individual risers. Body constructed of malleable-iron casting with hot-dip galvanized finish.

H. Expansion Anchors: Carbon-steel wedge or sleeve type.

I. Toggle Bolts: All-steel springhead type.

J. Powder-Driven Threaded Studs: Heat-treated steel.

2.2 ELECTRICAL IDENTIFICATION

A. Identification Device Colors: Use those prescribed by ANSI A13.1, NFPA 70, and these Specifications.

B. Colored Adhesive Marking Tape for Raceways, Wires, and Cables: Self-adhesive vinyl tape, not less than 1 inch wide by 3 mils thick.

C. Tape Markers for Conductors: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.

D. Color-Coding Cable Ties: Type 6/6 nylon, self-locking type. Colors to suit coding scheme.

E. Underground Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape compounded for permanent direct-burial service, and with the following features:

1. Not less than 6 inches wide by 4 mils thick.

2. Embedded continuous metallic strip or core.

3. Printed legend that indicates type of underground line.

F. Engraved-Plastic Labels, Signs, and Instruction Plates: Engraving stock, melamine plastic laminate punched or drilled for mechanical fasteners 1/16-inch minimum thickness for signs up to 20 sq. in. and 1/8-inch minimum thickness for larger sizes. Engraved legend in black letters on white background.

G. Warning and Caution Signs: Preprinted; comply with 29 CFR 1910.145, Chapter XVII. Colors, legend, and size appropriate to each application.

1. Interior Units: Aluminum, baked-enamel-finish, punched or drilled for mechanical fasteners.

2. Exterior Units: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate with 0.0396-inch, galvanized-steel backing. 1/4-inch grommets in corners for mounting.

H. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.

2.3 CONCRETE BASES

A. Concrete Forms and Reinforcement Materials: As specified in Division 3 Section "Cast-in-Place Concrete."

B. Concrete: 3000-psi, 28-day compressive strength.

2.4 CONCRETE BOXES

A. Concrete Boxes: Pre-cast reinforced, size and type as shown; Christy, Brooks or approved equal. All underground boxes shall be provided with traffic grade, spring loaded, bolt-down, steel cover.

PART 3 - EXECUTION

3.1 ELECTRICAL EQUIPMENT INSTALLATION

A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom.

B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.

C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.

D. Right of Way: Give to raceways and piping systems installed at a required slope.

3.2 ELECTRICAL SUPPORTING DEVICE APPLICATION

A. Damp Locations and Outdoors: Hot-dip galvanized materials or nonmetallic, slotted channel system components.

B. Dry Locations: Steel materials.

C. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four with, 200-lb minimum design load for each support element.

3.3 SUPPORT INSTALLATION

A. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.

B. Size supports for multiple raceway or cable runs so capacity can be increased by a 25 percent minimum in the future.

C. Support individual horizontal single raceways with separate, malleable-iron pipe hangers or clamps except use spring-steel fasteners for 1-1/2-inch and smaller single raceways above suspended ceilings and for fastening raceways to slotted channel and angle supports.

D. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.

E. Secure electrical items and their supports to building structure, using the following methods unless other fastening methods are indicated:

1. Wood: Wood screws or screw-type nails.

2. Gypsum Board: Toggle bolts. Seal around sleeves with joint compound, both sides of wall.

3. Masonry: Toggle bolts on hollow block and expansion bolts on solid block. Seal around sleeves with mortar, both sides of wall.

4. New Concrete: Concrete inserts with machine screws and bolts.

5. Existing Concrete: Expansion bolts.

6. Structural Steel: Spring-tension clamps.

    a. Comply with AWS D1.1 for field welding.

7. Light Steel Framing: Sheet metal screws.

8. Fasteners for Damp, Wet, or Weather-Exposed Locations: Stainless steel.

9. Light Steel: Sheet-metal screws.

10. Fasteners: Select so load applied to each fastener does not exceed 25 percent of its proof-test load.

3.4 IDENTIFICATION MATERIALS AND DEVICES

A. Install at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated in the Contract Documents or required by codes and standards. Use consistent designations throughout Project.

C. Self-Adhesive Identification Products: Clean surfaces before applying.

D. Tag and label circuits designated to be extended in the future. Identify source and circuit numbers in each cabinet, pull and junction box, and outlet box. Color-coding may be used for voltage and phase identification.

E. Install continuous underground plastic markers during trench backfilling, for exterior underground power, control, signal, and communication lines located directly above power and communication lines. Locate 6 to 8 inches below finished grade. If width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches, overall, use a single line marker.

F. Install warning, caution, and instruction signs where required to comply with 29 CFR 1910.145, Chapter XVII, and where needed to ensure safe operation and maintenance of electrical systems and of items to which they connect. Indoors install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.

G. Install, where applicable, engraved-laminated emergency-operating signs with white letters on red background with minimum 3/8-inch- high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.

H. Provide service description etched on cover of all underground pull boxes.

3.5 FIRESTOPPING

A. Apply firestopping to cable and raceway sleeves and other penetrations of fire-rated floor and wall assemblies to restore original undisturbed fire-resistance ratings of assemblies. Firestopping installation is specified in Division 7 Section "Through-Penetration Firestop Systems."

3.6 CONCRETE BASES

A. Construct concrete bases of dimensions indicated, but not less than 4 inches larger, in both directions, than supported unit. Follow supported equipment manufacturer's anchorage recommendations and setting templates for anchor-bolt and tie locations, unless otherwise indicated.

3.7 DEMOLITION

A. Protect existing electrical equipment and installations indicated to remain. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.

B. Accessible Work: Remove exposed electrical equipment and installations, indicated to be demolished, in their entirety.

C. Abandoned Work: Cut and remove buried raceway and wiring, indicated to be abandoned in place, 2 inches below the surface of adjacent construction. Cap raceways and patch surface to match existing finish.

D. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.

3.8 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.

B. Repair, refinish and touch up disturbed finish materials and other surfaces to match adjacent undisturbed surfaces.

END OF SECTION

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SECTION 26 05 19
CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

1.2 SUBMITTALS

A. Field quality-control test reports.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 CONDUCTORS AND CABLES

A. Manufacturers:

1. Alcan Aluminum Corporation; Alcan Cable Div.
2. American Insulated Wire Corp.; a Leviton Company.
3. General Cable Corporation.
4. Senator Wire & Cable Company.
5. Southwire Company.

B. Refer to Part 3 "Conductor and Insulation Applications" Article for insulation type, cable construction, and ratings.

C. Conductor Material: Copper complying with NEMA WC 5 or 7; solid conductor for No. 10 AWG and smaller, stranded for No. 8 AWG and larger.

D. Conductor Insulation Types: Type THW, THHN-THWN or XHHW complying with NEMA WC 5 or 7.

2.3 CONNECTORS AND SPLICES

A. Manufacturers:

1. AMP Incorporated/Tyco International.

2. Hubbell/Anderson.

3. O-Z/Gedney; EGS Electrical Group LLC.

4. 3M Company; Electrical Products Division.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR AND INSULATION APPLICATIONS

A. Service Entrance: Type THHN-THWN, single conductors in raceway.

B. Exposed Feeders: Type THHN-THWN, single conductors in raceway .

C. Feeders Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and in Crawlspaces: Type THHN-THWN, single conductors in raceway.

E. Exposed Branch Circuits, including in Crawlspaces: Type THHN-THWN, single conductors in raceway.

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

G. Branch Circuits Concealed in Concrete and below Slabs-on-Grade: Type THHN-THWN, single conductors in raceway.

H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord.

I. Fire Alarm Circuits: Type THHN-THWN, in raceway.

J. Class 1 Control Circuits: Type THHN-THWN, in raceway.

K. Class 2 Control Circuits: Type THHN-THWN, in raceway.

3.2 INSTALLATION

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Install exposed feeders parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Support cables according to Division 26.

F. Seal around cables penetrating fire-rated elements according to Section "Through-Penetration Firestop Systems."

G. Identify and color-code conductors and cables according to Division 26 Section "Basic Electrical Materials and Methods."

H. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

I. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.3 FIELD QUALITY CONTROL

A. Testing: Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.3.1. Certify compliance with test parameters.

B. Test Reports: Prepare a written report to record the following:

1. Test procedures used.

2. Test results that comply with requirements.

3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

END OF SECTION

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SECTION 26 05 26
GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes grounding of electrical systems and equipment. Requirements specified in this Section may be supplemented by requirements of other Sections.

1.2 SUBMITTALS

A. Product Data: For ground rods.

B. Field quality-control test reports.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled under UL 467 as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Boggs, Inc.
2. Copperweld Corp.
3. Dossert Corp.
4. Erico Inc.; Electrical Products Group.
5. Galvan Industries, Inc.
6. Harger Lightning Protection, Inc.
7. Hastings Fiber Glass Products, Inc.
8. Heary Brothers Lightning Protection Co.
9. ILSCO.
10. Kearney/Cooper Power Systems.
11. Korns, C. C. Co.; Division of Robroy Industries.
12. Lightning Master Corp.
13. Lyncole XIT Grounding.

14. O-Z/Gedney Co.; a business of the EGS Electrical Group.

15. Robbins Lightning, Inc.

16. Salisbury, W. H. & Co.

17. Superior Grounding Systems, Inc.

18. Thomas & Betts, Electrical.

2.2 GROUNDING CONDUCTORS

A. For insulated conductors, comply with Division 16 Section "Conductors and Cables."

B. Equipment Grounding Conductors: Insulated with green-colored insulation.

C. Isolated Ground Conductors: Insulated with green-colored insulation with yellow stripe. On feeders with isolated ground, use colored tape, alternating bands of green and yellow tape to provide a minimum of three bands of green and two bands of yellow.

D. Grounding Electrode Conductors: Stranded cable.

E. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.

F. Bare, Solid-Copper Conductors: ASTM B 3.

G. Assembly of Bare, Stranded-Copper Conductors: ASTM B 8.

H. Bare, Tinned-Copper Conductors: ASTM B 33.

I. Copper Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor.

J. Copper Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

K. Tinned-Copper Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

L. Grounding Bus: Bare, annealed copper bars of rectangular cross section, with insulated spacer.

M. Connectors: Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items. Exothermic-welded type, in kit form, selected per manufacturer's written instructions.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel.

1. Size: 3/4 inches in diameter by 120 inches long.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.

B. In raceways, use insulated equipment grounding conductors.

C. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections.

D. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Use insulated spacer; space 1 inch from wall and support from wall 6 inches above finished floor, unless otherwise indicated.

2. At doors, route the bus up to the top of the door frame, across the top of the doorway, and down to the indicated height above the floor.

E. Underground Grounding Conductors: Use copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches below grade or bury 12 inches above duct bank when installed as part of the duct bank.

F. Equipment Grounding Conductors: Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.

1. Install insulated equipment grounding conductors in feeders.

2. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate grounding conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

3. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.

4. Air-Duct Equipment Circuits: Install an insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners and heaters. Bond conductor to each unit and to air duct.

5. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install an insulated equipment grounding conductor to each electric water heater, heat-tracing, and antifrost heating cable. Bond conductor to heater units, piping, connected equipment, and components.

6. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location and per Division 27.

a. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a grounding bus per Division 27.

b. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

7. Metal Poles Supporting Outdoor Lighting Fixtures: Provide a grounding electrode in addition to installing an insulated equipment grounding conductor with supply branch-circuit conductors.

G. Ground Rods: Install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes.

1. Drive ground rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.

2. Interconnect ground rods with grounding electrode conductors. Use exothermic welds, except as otherwise indicated. Make connections without exposing steel or damaging copper coating.

H. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

I. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers or supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.

J. Metal Water Service Pipe: Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

K. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding clamp connectors.

L. Bond each aboveground portion of gas piping system upstream from equipment shutoff valve.

M. Connections: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.

2. Make connections with clean, bare metal at points of contact.

3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.

4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.

5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

6. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

7. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.

8. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.

9. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

10. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

11. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

N. Manholes and Handholes: Install a driven ground rod close to wall and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide a No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.

O. Connections to Manhole Components: Connect exposed-metal parts, such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.

3.2 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality-control testing:

1. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.

2. Test completed grounding system at each location where a maximum ground-resistance level is indicated and at service disconnect enclosure grounding terminal. Measure ground resistance not less than two full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests, by the fall-of-potential method according to IEEE 81.

3. Provide drawings locating each ground rod, ground rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results. Nominal maximum values are as follows:

    a. Equipment Rated 500 kVA and Less: 10 ohms.

    b. Equipment Rated 500 to 1000 kVA: 5 ohms.

    c. Equipment Rated More Than 1000 kVA: 3 ohms.

    d. Substations and Pad-Mounted Switching Equipment: 5 ohms.

    e. Manhole Grounds: 10 ohms.

END OF SECTION

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SECTION 26 05 29
SEISMIC CONTROLS FOR ELECTRICAL WORK

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes seismic restraints and other earthquake-damage-reduction measures for electrical components. It applies to and complements optional seismic-restraint requirements in the various electrical component Sections of these Specifications.

1.2 DEFINITIONS

A. Seismic Restraint: A fixed device (a seismic brace, an anchor bolt or stud, or a fastening assembly) used to prevent vertical or horizontal movement, or both vertical and horizontal movement, of an electrical system component during an earthquake.

B. Mobile Structural Element: A part of the building structure such as a slab, floor structure, roof structure, or wall that may move independently of other structural elements during an earthquake.

1.3 SUBMITTALS

A. Product Data: Illustrate and indicate types, styles, materials, strength, fastening provisions, and finish for each type and size of seismic-restraint component used. Include documentation of evaluation and approval of components by agencies acceptable to authorities having jurisdiction.

B. Shop Drawings: For components, physical arrangements, and installation details not defined by Drawings. Indicate materials and show calculations, design analysis, details, and layouts, signed and sealed by a professional engineer.

C. Pre-approval and Evaluation Documentation: By an agency approved by authorities having jurisdiction, showing maximum ratings of restraints.

D. Qualification data.

E. Field quality-control test reports.

1.4 QUALITY ASSURANCE

A. Comply with seismic-restraint requirements in California Building Code, unless requirements in this Section are more stringent.

B. Testing Agency Qualifications: An independent testing and inspection agency, acceptable to authorities having jurisdiction, with the experience and capability to conduct the inspection indicated.

1.5 PROJECT CONDITIONS

A. Project Seismic Zone and Zone Factor as Defined in CBC.

1.6 COORDINATION

A. Coordinate layout and installation of seismic bracing with building structure, architectural features, and mechanical, fire-protection, electrical, and other building systems.

B. Coordinate concrete bases with building structural system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amber/Booth Company, Inc.
2. B-Line Systems, Inc.
3. Erico, Inc.
4. GS Metals Corp.
5. Loos & Company, Inc.
6. Mason Industries, Inc,
7. Powerstrut.
8. Thomas & Betts Corp.
9. Unistrut Corporation.

2.2 MATERIALS

A. Use the following materials for restraints:

1. Indoor Dry Locations: Steel, zinc plated.
2. Outdoors and Damp Locations: Galvanized steel.
3. Corrosive Locations: Stainless steel.

2.3 ANCHORAGE AND STRUCTURAL ATTACHMENT COMPONENTS

A. Strength: Defined in reports by ICBO Evaluation Service or another agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Strength in tension and shear of components shall be at least twice the maximum seismic forces for which they are required to be designed.

B. Concrete and Masonry Anchor Bolts and Studs: Steel-expansion wedge type.

C. Concrete Inserts: Steel-channel type.

D. Through Bolts: Structural type, hex head, high strength. Comply with ASTM A 325.

E. Welding Lugs: Comply with MSS SP-69, Type 57.

F. Beam Clamps for Steel Beams and Joists: Double sided. Single-sided type is not acceptable.

G. Bushings for Floor-Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings, and matched to the type and size of anchor bolts and studs used.

H. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to the type and size of attachment devices used.

2.4 SEISMIC-BRACING COMPONENTS

A. Slotted Steel Channel: 1-5/8-by-1-5/8-inch cross section, formed from 0.1046-inch-thick steel, with 9/16-by-7/8-inch slots at a maximum of 2 inches o.c. in webs, and flange edges turned toward web.

1. Materials for Channel: ASTM A 570, GR 33.

2. Materials for Fittings and Accessories: ASTM A 575, ASTM A 576, or ASTM A 36.

3. Fittings and Accessories: Products of the same manufacturer as channels and designed for use with that product.

4. Finish: Baked, rust-inhibiting, acrylic-enamel paint applied after cleaning and phosphate treatment, unless otherwise indicated.

B. Channel-Type Bracing Assemblies: Slotted steel channel, with adjustable hinged steel brackets and bolts.

C. Hanger Rod Stiffeners: Slotted steel channels, installed vertically, with internally bolted connections to hanger rod.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install seismic restraints according to applicable codes and regulations and as approved by authorities having jurisdiction, unless more stringent requirements are indicated.

B. Install structural attachments as follows:

1. Use bolted connections with steel brackets, slotted channel, and slotted-channel fittings to spread structural loads and reduce stresses.

2. Attachments to New Concrete: Bolt to channel-type concrete inserts or use expansion anchors.

3. Attachments to Existing Concrete: Use expansion anchors.

4. Holes for Expansion Anchors in Concrete: Drill at locations and to depths that avoid reinforcing bars.

5. Attachments to Solid Concrete Masonry Unit Walls: Use expansion anchors.

6. Attachments to Hollow Walls: Bolt to slotted steel channels fastened to wall with expansion anchors.

7. Attachments to Wood Structural Members: Install bolts through members.

8. Attachments to Steel: Bolt to clamps on flanges of beams or on upper truss chords of bar joists.

C. Install electrical equipment anchorage as follows:

1. Anchor panelboards, motor-control centers, motor controls, switchboards, transformers, fused power-circuit devices, control, and distribution units as follows:

a. Anchor equipment rigidly to a single mobile structural element or to a concrete base that is structurally tied to a single mobile structural element.

b. Size concrete bases so expansion anchors will be a minimum of 10 bolt diameters from the edge of the concrete base.

c. Bushings for Floor-Mounted Equipment Anchors: Install to allow for resilient media between anchor bolt or stud and mounting hole in concrete.

d. Anchor Bolt Bushing Assemblies for Wall-Mounted Equipment: Install to allow for resilient media where equipment or equipment-mounting channels are attached to wall.

e. Torque bolts and nuts on studs to values recommended by equipment manufacturer.

D. Install seismic bracing as follows:

1. Install bracing according to spacings and strengths indicated by approved analysis.

2. Expansion and Contraction: Install to allow for thermal movement of braced components.

3. Attachment to Structure: If specific attachment is not indicated, anchor bracing to the structure at flanges of beams, upper truss chords of bar joists, or at concrete members.

E. Accommodation of Differential Seismic Motion: Make flexible connections in raceways, cables, wireway, cable trays, and busway where they cross expansion- and seismic-control joints, where adjacent sections or branches are supported by different structural elements, and where they terminate at electrical equipment anchored to a different mobile structural element from the one supporting them.

3.2 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing and inspection agency to inspect seismic-control installation for compliance with indicated requirements.

B. Testing Agency: Engage a qualified testing and inspection agency to inspect seismic-control installation for compliance with indicated requirements.

C. Reinspection: Correct deficiencies and verify by reinspection that work complies with requirements.

D. Provide written report of tests and inspections.

END OF SECTION

SECTION 26 13 00
RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.2 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets indicated.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 METAL CONDUIT AND TUBING

A. Manufacturers:

1. AFC Cable Systems, Inc.
2. Alflex Inc.
3. Anamet Electrical, Inc.; Anaconda Metal Hose.
4. Electri-Flex Co.
5. Grinnell Co./Tyco International; Allied Tube and Conduit Div.
6. LTV Steel Tubular Products Company.
7. Manhattan/CDT/Cole-Flex.
8. O-Z Gedney; Unit of General Signal.
9. Wheatland Tube Co.

B. Rigid Steel Conduit: ANSI C80.1.

C. Aluminum Rigid Conduit: ANSI C80.5.

D. IMC: ANSI C80.6.

E. EMT and Fittings: ANSI C80.3.

1. Fittings: Compression type.

F. FMC: Aluminum.

G. LFMC: Flexible steel conduit with PVC jacket.

H. Fittings: NEMA FB 1; compatible with conduit and tubing materials.

2.3 NONMETALLIC CONDUIT AND TUBING

A. Manufacturers:

1. American International.

2. Anamet Electrical, Inc.; Anaconda Metal Hose.

3. Arnco Corp.

4. Cantex Inc.

5. Certainteed Corp.; Pipe & Plastics Group.

6. Condux International.

7. ElecSYS, Inc.

8. Electri-Flex Co.

9. Lamson & Sessions; Carlon Electrical Products.

10. Manhattan/CDT/Cole-Flex.

11. RACO; Division of Hubbell, Inc.

12. Spiralduct, Inc./AFC Cable Systems, Inc.

13. Thomas & Betts Corporation.

B. RNC: NEMA TC 2, Schedule 40 and Schedule 80 PVC.

C. RNC Fittings: NEMA TC 3; match to conduit or tubing type and material.

2.4 SURFACE RACEWAYS

A. Surface Metal Raceways: Galvanized steel with snap-on covers. Finish with manufacturer's standard prime coating.

1. Manufacturers:

a. Airey-Thompson Sentinel Lighting; Wiremold Company (The).

b. Thomas & Betts Corporation.

c. Walker Systems, Inc.; Wiremold Company (The).

d. Wiremold Company (The); Electrical Sales Division.

B. Surface Nonmetallic Raceways: Two-piece construction, manufactured of rigid PVC compound with matte texture and manufacturer's standard color.

1. Manufacturers:

a. Butler Manufacturing Co.; Walker Division.

b. Enduro Composite Systems.

c. Hubbell, Inc.; Wiring Device Division.

d. Lamson & Sessions; Carlon Electrical Products.

e. Panduit Corp.

f. Walker Systems, Inc.; Wiremold Company (The).

g. Wiremold Company (The); Electrical Sales Division.

C. Types, sizes, and channels as indicated and required for each application, with fittings that match and mate with raceways.

2.5 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers:

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.

2. Emerson/General Signal; Appleton Electric Company.

3. Erickson Electrical Equipment Co.

4. Hoffman.

5. Hubbell, Inc.; Killark Electric Manufacturing Co.

6. O-Z/Gedney; Unit of General Signal.

7. RACO; Division of Hubbell, Inc.

8. Robroy Industries, Inc.; Enclosure Division.

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover.

D. Nonmetallic Outlet and Device Boxes: NEMA OS 2.

E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

F. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.

G. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

H. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage and include accessory feet where required for freestanding equipment.

I. Concrete Boxes: Pre-cast reinforced, size and type as shown; Christy, Brooks or approved equal. All underground boxes shall be provided with traffic grade, spring loaded, bolt-down, steel cover.

2.6 FACTORY FINISHES

A. Finish: For raceway, enclosure, or cabinet components provide manufacturer's standard prime-coat finish ready for field painting.

2.7 FIRESTOPPING FOR LOW VOLTAGE SLEEVES

A. Firestop Pillows: STI SpecSeal® Brand re-enterable, non-curing, mineral fiber core encapsulated on six sides with intumescent coating contained in a flame retardant poly bag, the following products are acceptable:

1. Specified Technologies Inc. (STI) SpecSeal® Series SSB Pillows.

B. Fire Rated Cable Pathways: STI EZ-PATH™ Brand device modules comprised of steel raceway with intumescent foam pads allowing 0 to 100 percent cable fill, the following products are acceptable:

1. Specified Technologies Inc. (STI) EZ-PATH™ Fire Rated Pathway.

2. Specified Technologies Inc. (STI) Mini EZ-PATH™ Fire Rated Pathway.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors:

1. Exposed: Rigid steel or IMC.

2. Concealed: Rigid steel or IMC.

3. Underground, Single Run: RNC.

4. Underground, Grouped: RNC.

5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.

6. Boxes and Enclosures: NEMA 250, Type 3R.

7. Underground duct bank conduit spacers.

8. Backfill materials per civil site requirements.

B. Indoors:

1. Exposed: EMT.

2. Concealed: EMT.

3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except use LFMC in damp or wet locations.

4. Damp or Wet Locations: Rigid steel conduit.

5. Boxes and Enclosures: NEMA 250, Type 1, except as follows:

a. Damp or Wet Locations: NEMA 250, Type 4, stainless steel.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings approved for use with that material. Patch all nicks and scrapes in PVC coating after installing conduits.

3. For Outdoor Use – conduit hub, NEMA 4 for conduit connection/terminating to cabinet/panel/boxes.

4. All connectors to be steel. Die cast connectors are not acceptable.

E. Do not install aluminum conduits embedded in or in contact with concrete.

3.2 INSTALLATION

A. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

B. Complete raceway installation before starting conductor installation.

C. Support raceways as specified in Division 16 Section "Basic Electrical Materials and Methods."

D. Install temporary closures to prevent foreign matter from entering raceways.

E. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portions of bends are not visible above finished slab.

F. Make bends and offsets so ID is not reduced. Keep legs of bends in same plane and keep straight legs of offsets parallel, unless otherwise indicated.

G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

1. Install concealed raceways with a minimum of bends in shortest practical distance, considering type of building construction and obstructions, unless otherwise indicated.

H. Raceways Embedded in Slabs: Install in middle 1/3 of slab thickness where practical and leave at least 2 inches of concrete cover.

1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.

2. Space raceways laterally to prevent voids in concrete.

3. Run conduit larger than 1-inch trade size parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.

4. Change from nonmetallic tubing to Schedule 80 nonmetallic conduit, rigid steel conduit, or IMC before rising above floor.

I. Install exposed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.

1. Run parallel or banked raceways together on common supports.

2. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.

J. Join raceways with fittings designed and approved for that purpose and make joints tight.

1. Use insulating bushings to protect conductors on all raceways 2” and larger.

K. Tighten set screws of threadless fittings with suitable tools.

L. Terminations:

1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box.

2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.

M. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.

N. Telephone and Signal System Raceways, 2-Inch Trade Size and Smaller: In addition to above requirements, install raceways in maximum lengths of 150 feet and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.

O. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.

2. Where otherwise required by NFPA 70.

P. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches above the floor. Install screwdriver-operated, threaded plugs flush with floor for future equipment connections.

Q. Flexible Connections: Use maximum of 72 inches of flexible conduit for recessed and semi-recessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use LFMC in damp or wet locations. Install separate ground conductor across flexible connections.

R. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying raceways to receptacle or fixture ground terminals.

S. Set floor boxes level and flush with finished floor surface.

T. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

3.3 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 26 27 26
WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Single and duplex receptacles, ground-fault circuit interrupters.
2. Single- and double-pole snap switches and dimmer switches.
3. Device wall plates.
4. Floor service outlets, poke-through assemblies and multioutlet assemblies.

1.2 SUBMITTALS

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

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Wiring Devices:
    a. Bryant Electric, Inc./Hubbell Subsidiary.
    b. Eagle Electric Manufacturing Co., Inc.
    c. Hubbell Incorporated; Wiring Device-Kellems.
    d. Leviton Mfg. Company Inc.
    e. Pass & Seymour/Legrand; Wiring Devices Div.

2. Multioutlet Assemblies:

   a. Hubbell Incorporated; Wiring Device-Kellems.

   b. Wiremold Company (The).

3. Poke-Through, Floor Service Outlets and Telephone/Power Poles:

   a. Hubbell Incorporated; Wiring Device-Kellems.

   b. Pass & Seymour/Legrand; Wiring Devices Div.

   c. Square D/Groupe Schneider NA.

   d. Thomas & Betts Corporation.

   e. Wiremold Company (The).

2.2 RECEPTACLES

A. Straight-Blade and Locking Receptacles: Heavy-Duty grade.

B. Straight-Blade Receptacles: Hospital grade.

C. GFCI Receptacles: Straight blade, non-feed-through type, Hospital or Heavy-Duty grade, with integral NEMA WD 6, Configuration 5-20R duplex receptacle; complying with UL 498 and UL 943. Design units for installation in a 2-3/4-inch deep outlet box without an adapter.

2.3 SWITCHES

A. Single- and Double-Pole Switches: Comply with DSCC W-C-896F and UL 20.

B. Snap Switches: Heavy-Duty grade, quiet type.

C. Combination Switch and Receptacle: Both devices in a single gang unit with plaster ears and removable tab connector that permit separate or common feed connection.

   1. Switch: 20 A, 120/277-V ac.

   2. Receptacle: NEMA WD 6, Configuration 5-20R.

D. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on/off switches and audible frequency and EMI/RFI filters.

   1. Control: Continuously adjustable slider; with single-pole or three-way switching to suit connections.

   2. Incandescent Lamp Dimmers: Modular, 120 V, 60 Hz with continuously adjustable rotary knob, toggle switch, or slider; single pole with soft tap or other quiet switch; EMI/RFI filter to eliminate interference; and 5-inch wire connecting leads.

3. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.4 WALL PLATES

A. Single and combination types to match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.

2. Material for Finished Spaces:

a. Steel with white baked enamel, suitable for field painting

b. 0.035-inch thick, satin-finished stainless steel (above counters and in restrooms)

3. Material for Unfinished Spaces: Galvanized steel.

4. Material for Wet Locations: Cast aluminum with spring-loaded, lockable, lift cover, and listed and labeled for use in "wet locations."

2.5 FLOOR SERVICE FITTINGS

A. Type: Modular, flush-type, dual-service units suitable for wiring method used.

B. Compartments: Barrier separates power from voice and data communication cabling.

C. Service Plate: Rectangular, solid brass with satin finish.

D. Power Receptacle: NEMA WD 6, Configuration 5-20R, gray finish, unless otherwise indicated.

E. Voice and Data Communication Outlet: See telecommunication specifications for requirements.

F. Wiremold RFB4-4DB series complete with brackets, devices, corresponding covers and hardware.

2.6 POKE-THROUGH ASSEMBLIES

A. Description: Factory-fabricated and -wired assembly of below-floor junction box with multichanneled, through-floor raceway/firestop unit and detachable matching floor service outlet assembly.

1. Service Outlet Assembly: Flush type with two simplex receptacles and space for two RJ-45 jacks.

2. Size: Selected to fit nominal 4-inch cored holes in floor and matched to floor thickness.

3. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.

4. Closure Plug: Arranged to close unused 4-inch cored openings and reestablish fire rating of floor.

5. Wiring Raceways and Compartments: For a minimum of four No. 12 AWG conductors; and a minimum of four, 4-pair, Category 6 voice and data communication cables.

2.7 MULTIOUTLET ASSEMBLIES

A. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.

B. Raceway Material: PVC.

C. Wire: No. 12 AWG.

2.8 FINISHES

A. Color:

1. Wiring Devices Connected to Normal Power System: As selected by Architect, unless otherwise indicated or required by NFPA 70.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install devices and assemblies level, plumb, and square with building lines.

B. Install wall dimmers to achieve indicated rating after derating for ganging.

C. Install unshared neutral conductors on line and load side of dimmers.

D. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical, and with grounding terminal of receptacles on bottom. Group adjacent switches under single, multigang wall plates.

E. Remove wall plates and protect devices and assemblies during painting.

F. Adjust locations of floor service outlets to suit arrangement of partitions and furnishings.

3.2 IDENTIFICATION

A. Comply with Division 26 Section "Basic Electrical Materials and Methods."

1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

2. Submit same for approval.

3.3 CONNECTIONS

A. Ground equipment according to Division 26 Section "Grounding and Bonding."

B. Connect wiring according to Division 26 Section "Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections:

1. After installing wiring devices and after electrical circuitry has been energized, test for proper polarity, ground continuity, and compliance with requirements.

2. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.

B. Remove malfunctioning units, replace with new units, and retest as specified above.

END OF SECTION

SECTION 26 28 16
ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following individually mounted, enclosed switches and circuit breakers:

1. Fusible switches.
2. Nonfusible switches.
3. Molded-case circuit breakers.
4. Enclosures.

1.2 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated.

B. Field quality-control test reports.

C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 FUSIBLE AND NONFUSIBLE SWITCHES

A. Manufacturers:

1. Eaton Corporation; Cutler-Hammer Products.
2. General Electric Co.; Electrical Distribution & Control Division.
3. Siemens Energy & Automation, Inc.

4. Square D/Group Schneider.

B. Fusible Switch, 600 A and Smaller: NEMA KS 1, Type GD, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Nonfusible Switch, 600 A and Smaller: NEMA KS 1, Type GD, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

D. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.

2. Neutral Kit: Internally mounted; insulated, capable of being grounded, and bonded; and labeled for copper and aluminum neutral conductors.

3. Auxiliary Contact Kit: Auxiliary set of contacts arranged to open before switch blades open (required for all disconnects located downstream of Variable frequency Drives)

2.3 MOLDED-CASE CIRCUIT BREAKERS AND SWITCHES

A. Manufacturers:

1. Eaton Corporation; Cutler-Hammer Products.

2. General Electric Co.; Electrical Distribution & Control Division.

3. Siemens Energy & Automation, Inc.

4. Square D/Group Schneider.

B. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

3. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller and let-through ratings less than NEMA FU 1, RK-5.

4. GFCI Circuit Breakers: Single- and two-pole configurations with 30-mA trip sensitivity.

C. Molded-Case Circuit-Breaker Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.

2. Lugs: Mechanical style suitable for number, size, trip ratings, and conductor material.

3. Application Listing: Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.

4. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.

2.4 ENCLOSURES

A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.

1. Outdoor Locations: NEMA 250, Type 3R.

2. Kitchen Areas: NEMA 250, Type 4X, stainless steel.

3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate size and location of concrete bases. Verify structural requirements with structural engineer.

B. Concrete base is specified in Division 26 Section "Basic Electrical Materials and Methods," and concrete materials and installation requirements are specified in Division 3.

C. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.

D. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated. Anchor floor-mounting switches to concrete base.

E. Comply with mounting and anchoring requirements specified in Division 26 Section "Seismic Controls for Electrical Work."

F. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

G. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Basic Electrical Materials and Methods."

3.2 FIELD QUALITY CONTROL

A. Prepare for acceptance testing as follows:

1. Inspect mechanical and electrical connections.

2. Verify switch and relay type and labeling verification.

3. Verify rating of installed fuses.

B. Perform the following field tests and inspections and prepare test reports:

1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.

2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

END OF SECTION

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SECTION 27 05 26
TELECOMMUNICATIONS GROUNDING PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, sections included under Divisions 1, 26, and 27 are included as part of this section as though bound herein.

B. Section 27 01 00 General Requirements

C. Section 27 15 00 – Horizontal Cabling

1.2 SUMMARY

A. This Section specifies the minimum materials and performance standards for grounding and bonding installed specifically for telecommunication systems in West Contra Costa Unified School District new construction and remodels.

1. Sections include:
   a. Grounding electrodes and conductors.
   b. Grounding electrodes.
   c. Equipment grounding conductors.
   d. Bonding.

1.3 REFERENCES

A. American National Standards Institute (ANSI) Publication C2-97 – National Electrical Safety Code; ANSI/IEEE Std. 1100-1999 – Recommended Practice for Powering and Grounding Sensitive Electronic Equipment in Industrial and Commercial Power Systems; ANSI/NFPA 780 – Lightning Protection Code Electronic Industries Association and Telecommunication Industries Association (EIA/TIA) Publications:

1. EIA/TIA 568B – Commercial Building Telecommunications Wiring Standard.
2. EIA/TIA 569 – Commercial Building Standard for Telecommunications Pathways.
3. EIA/TIA 607 – Grounding and Bonding for Communications.

B. Institute of Electrical and Electronic Engineers (IEEE) Publication 142 – Recommended Practice for Grounding of Industrial and Commercial Power Systems.

C. National Fire Protection Association (NFPA) Publication:

1. 70 – National Electrical Code (NEC).
2. 780 – Lightning Protection Code.

D. Underwriters Laboratories, Inc. (U.L.) Publication:

1. 83 - Thermoplastic Insulated Wires.

2. 467 - Grounding and Bonding Equipment.
3. 486A - Wire Connectors and Soldering Lugs for Use with Copper Conductors.

1.4 REGULATORY REQUIREMENTS

A. The Contractor shall conform to requirements of the National Electrical Code Article 250, California Electrical Code, and requirements for EIA/TIA 607.

B. The Contractor shall furnish products listed and classified by Underwriters Laboratories, Inc. or testing firm acceptable to the SDUSD as suitable for purpose specified and shown.

1.5 PERFORMANCE REQUIREMENTS

A. Grounding system resistance shall be 5 ohms or less unless otherwise indicated.

B. A telecommunications ground in the form of telecommunication main ground busbar (TMGB) shall be installed in the Main Distribution Frame (MDF) cabinet. It will be directly attached and effectively bonded to the closest point in the building's electrical service grounding electrode system.

C. In the event the building's service grounding electrode system is not in close proximity of the TMGB, install a driven ground rod for the telecommunication grounding system.

D. Each Building Distribution Frame (BDF) shall be effectively bonded with the TMGB in the MDF. Each BDF ground shall be a separate grounding conductor between the BDF and the MDF.

1.6 SUBMITTALS:

A. The following information shall be submitted for review and approval in accordance with Section 26 01 00, "General Electrical Requirements".

1. Catalog Cut:

a. Ground Rod.
b. Ground Connectors
c. Telecommunications Main Grounding Busbar.

2. Ground resistance from each major piece of equipment to the ground electrode. Equipment shall include, but not be limited to the following:

a. Main Distribution Frame (MDF).
b. Building Distribution Frame (BDF).

1.7 WARRANTY

A. Warranty shall comply with the provisions of Section 26 01 00, "General Electrical Requirements".

PART 2 - PRODUCTS

2.1 Telecommunication Main Grounding Bus Bar (TMGB):

A. Provide 2" wide x 3/16" thick copper ground bus, (length as necessary to accommodate all MDF/BDFIDF ground connections).

2.2 GROUND RODS:

A. Provide copper clad steel with adequate diameter to permit driving it full length of the rod in the earth but not less than ¾-inch. Length shall be 10-feet unless otherwise indicated.

2.3 GROUNDING AND BONDING CONDUCTORS

A. Grounding and bonding conductors shall be sized in accordance with Table for equipment grounding conductors, NEC. 250, ANSI/TIA/EIA – 607.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Make mechanical and electrical contact at all MDFs and BDFs. Permanently and effectively ground all equipment as required by all applicable codes, regulations and standards.

B. Drive ground rods full length in a depression at least six (6)-inches below finished grade.

1. Provide minimum No. 4/0 AWG, insulated, stranded copper grounding conductor between TMGB in MDF and electrical system ground

2. Provide minimum No. 6 AWG, insulated, stranded copper grounding conductor between individual BDFs and the MDF TMGB.

3.2 TESTS:

A. All testing shall be performed by the technology contractor and shall be witnessed by the Architect and/or the District's designated representative.

B. As an exception to requirements that may be stated elsewhere in the contract, the Consultant shall be given five (5) working days notice prior to each test.

C. The testing equipment and devices used in performing the required tests shall have a calibration sticker affixed to the device stating the date when calibrated, date due for re-calibration, and the signature of the individual who did the calibration. In addition to the sticker, a certificate shall also contain the brand name and the serial number of the device.

D. Ground Rod Test: Test ground rods for ground resistance value before any wire is connected. A portable testing megger shall be used to test each ground or group of grounds. The auxiliary or reference ground rods shall be ¾-inch copper clad steel, not less than 4-feet in length and driven 3-1/2 feet deep, and shall be installed in a straight line from the ground being tested. Number 14 AWG stranded wire leads with at least 600 volt rubber insulation shall be connected to binding post on the instrument.

1. The instrument shall be equipped with a meter reading directly in ohms or fractions thereof to indicate the ground value of the ground electrode under test. Provide one (1) copy of the megger manufacturer's directions for use of the ground megger indicating the methods to be used.

E. Test Report (Submit four (4) copies in writing):

1. Grounding electrodes and systems (identifying electrodes and systems, each test).

END OF SECTION

SECTION 27 01 00
GENERAL TECHNOLOGY REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. General Requirements

B. Scope: Data, Telephone/Voice

C. Industry Guidelines and Standards

D. Submittals

1.2 GENERAL REQUIREMENTS

A. Manufacturer: The term “manufacturer” shall be defined as the company, or group of companies, that actually produces the products meeting the requirements of Section 2 of this document. The manufacturer shall have a minimum of seven (7) years experience in manufacturing products of this type and shall be ISO 9001 Certified.

B. Contractor: The term “contractor” shall be defined as the company, or group of companies, that actually installs the product. The contractor selected to provide the installation of this system shall be certified by the manufacturer in all aspects of design, installation and testing of the products described herein.

1. The contractor shall hold a valid State of California C-7 Or C-10 Contractor’s license, shall have completed at least ten (10) projects of equal scope, shall have been in business of furnishing and installing systems of this scope and magnitude for at lest three (3) years and capable of being bonded to assure the Owner’s Project Manager of performance and satisfactory service during the guarantee period.

2. The contractor shall hold all other licenses required by the legally constituted authorities having jurisdiction over the work.

3. All work shall be performed under the supervision of a company accredited by the manufacturer and such accreditation must be presented.

4. The contractor shall be a manufacturer’s authorized distributor and warrantee station for the equipment offered and shall maintain a fully equipped service organization capable of furnishing adequate repair service to the equipment. The contractor shall maintain a spare set of all major parts for the system at all times.

5. The contractor selected for this Project must adhere to the engineering, installation and testing procedures and utilize the authorized manufacturer components and distribution channels in provisioning this Project.

6. The contractor shall own and maintain tools and equipment necessary for successful installation and testing of optical and Category 6A metallic premise distribution

systems and have personnel who are adequately trained in the use of such tools and equipment.

7. All of the equipment in this specification shall be furnished and installed by the Authorized Factory Distributor of the equipment. The Contractor shall furnish a letter from the manufacturer of all major equipment, which certifies that the installing contractor is the Authorized Distributor and that the equipment has been installed according to factory intended practices. The Contractor shall furnish a written guarantee from the manufacturer that they will have a service representative assigned to this area for the life of the equipment.

8. All communication system supplied shall be listed by Underwriter's Laboratories under UL Standard 1459. A copy of the UL listing card for the proposed system shall be included with the contractor's submittal.

C. Responsible Person for Contractor: Submit name of the individual authorized to receive construction change documents, and who is responsible for informing others in Contractor's employ or subcontractors of changes in the Work.

1.3 SCOPE OF WORK

A. DATA: The work shall include, but not be limited to the following objectives:

1. Install new data drops as indicated on plans. Contractor shall coordinate closely with District for required time to complete connection.

2. Only virgin materials shall be used in the construction of cabling.

3. Installation of a new Category 6AA UTP in rooms as required by the drawings or the scope of work. Category 6A terminations will be EIA/TIA standard 568B wiring configuration into RJ45 workstation data jacks (all jacks shall be blue in color for data and all cables shall be blue in color for data). All cables shall be installed with service loops at ground boxes and MDF/IDF locations only.

4. Coordinate with Section 27 14 16 "Audio Visual Systems" for all additional work required by electrical contractor.

5. Mount and install Switches as required by the drawings or the scope of work. Contractor shall notify the District in writing two weeks prior to the expected installation date of switches. Equipment shall be installed within Data Cabinets (provided by the contractor). Data Cabinets will be dual access and fully enclosed (See Materials List)

6. Testing of cables and connections to insure a complete and operable end-to-end data connection using EIA/TIA TSB-67 testing guidelines at level II accuracy for Category 6A, and EIA/TIA 455a for fiber.

7. All terminations into patch panel for connection to Switches using contractor supplied patch cords/station cables. For each data cable installed, the contractor shall supply one (1) 3' Category 6A patch cord for the patch panel location. In addition, the contractor shall supply 50% of 7' station cords and 50% of 10' station cords of the total number of data jacks installed. Station cords shall be delivered as directed by computer services in boxes clearly labeled with School name, quantity and size of

station cords. Contractor to install patch cords from patch-panel to switches.

8. Set up a complete wire management system at each IDF, this includes wire management organizer(s). Contractor shall provide one horizontal wire manager for each new Category 6A patch panel and one horizontal wire manager for each switch installed.

9. Warranty:

    a. Contractor shall warrant the installation and that all approved cabling components meet or exceed the requirements of TIA/EIA-568A, TIA/EIA-568A-A5, and ISO/IEC 11801.

    b. Contractor will provide a minimum of a fifteen (15) year written warranty from the manufacturer(s) for both UTP basic link and fiber optic cable systems. This may require the contractor to certify their installers to the manufacturer's guidelines before the project begins.

    c. The permanent link cabling system shall be warranted for a period of at least 25 years.

    d. The contractor will provide a two (2) year written warranty covering workmanship and materials in compliance with District specifications. All repairs shall be made at no cost to District during the warranty period.

    e. Contractor will provide to the District warranty information covering parts and materials used by the contractor.

    f. Upon hookup of system and system start-up by District, if system troubles should indicate problems with the cables or terminations, it shall be the responsibility of the cable installation contractor to repair any such problems free of charge to the District. The contractor shall start this repair work within a 48 hour period of time from initial notification by District.

B. TELEPHONE/VOICE: The work shall include but not be limited to the following objectives:

1. Only virgin materials shall be used in the construction of cabling.

2. Backbone feeder cables shall be Category 6A, size and number of pairs as indicated in drawings and Scope of Work documents. All pairs are to be terminated on 66m, 50 blocks and 89B standoffs.

3. All 66 blocks shall be mounted on blue-boards located in or near data cabinets.

4. Each 66-block shall have a minimum of a mushroom block and mushrooms installed per drawing details.

5. Installation of new Category 6A UTP in rooms as indicated on the drawings. Category 6A terminations will be EIA/TIA standard 568B wiring configuration into RJ45 workstation jacks (all telephone wire and jacks shall be blue in color). All cables shall be installed with service loops at ground boxes and MDF/IDF/CIDF locations only.

6. Testing of cables and connections to insure a complete and operable end-to-end data connection using EIA/TIA TSB-67 testing guidelines at level II accuracy for Category 6A.

C. INDUSTRY GUIDELINES AND STANDARDS

1. When Contract Documents differ from governing codes, furnish and install larger size or higher standards called for without extra charge. Notify the District Representative of any discrepancies prior to commencement of construction. Obtain written clarification prior to proceeding with work.

2. Fiber optic cable, electrical cable, wire and connectors shall be installed as indicated, in accordance with the manufacturer's written instructions, the applicable requirements of NEC and the National Electrical Contractors Association's "Standard of Installation", and in accordance with recognized industry practices to ensure that products serve the intended functions.

3. The National Fire Code (NFPA), National Electrical Code (NEC), California Electrical Code (CEC), California Building Code and Local Codes will be followed.

4. Applicable Standards

   a) National Electrical Code (NEC), most recent edition.

   b) ANSI/TIA/EIA-568-B -- Commercial Building Telecommunications Cabling Standard ANSI/TIA/EIA-568-A-1 -- Propagation Delay and Delay Skew Specifications for 100 ohm 4-pair Cable.

   c) ANSI/TIA/EIA-568-A-2 - Commercial Building Standards Updates

   d) ANSI/TIA/EIA-569-A -- Commercial Building Standard for Telecommunications Pathways and Spaces.

   e) ANSI/TIA/EIA-606 -- The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.

   f) ANSI/TIA/EIA-607 -- Commercial Building Grounding and Bonding Requirements for Telecommunications.

   g) ANSI/TIA/EIA TSB-67 -- Transmission Performance Specifications for Field-testing of Unshielded Twisted-Pair Cabling Systems.

   h) ANSI/TIA/EIA TSB-75 -- Additional Horizontal Cabling Practices for Open Offices.

   i) BICSI -- Telecommunications Distribution Methods Manual.

   j) BICSI -- Cabling Installation Manual.

   k) IEEE 802.3 "Carrier Sense Multiple Access with Collision Detection".

   l) IEEE 802.3ab "Gigabit Ethernet transmission over unshielded twisted pair (UTP)"

m) IEEE 802.z “1000Base-SX transmission over multi-mode fiber and 1000Base-LX transmission over single-mode fiber

n) ISO/IEC DIS 11801, January 6, 1994.

o) UL Cable Certification Program.

p) ANSI X3T9.5 Requirements for UTP at 100 Mbps.

q) EIA/TIA Technical Specification Bulletin 36. Technical Systems Bulletin additional Cable Specifications for Unshielded Twisted-Pair Cables.

r) EIA/TIA Technical Specification Bulletin 40. Technical Systems Bulletin additional Transmission Specifications for Unshielded Twisted-Pair Connecting Hardware.

s) TIA/EIA-607 Commercial Building Grounding and Bonding Requirements for Telecommunications.

t) EIA/TIA-455-61 FOTP-61 Measurement of Fiber or Cable Attenuation Using an OTDR.

u) ANSI/EIA/TIA-455-A-1991 Standard Test Procedures for Fiber Optic Fibers, Cables and Transducers, Sensors, Connecting and Terminating Devices, and other Fiber Optic Components

v) ANSI/ICEA S-83-596-1994, Fiber Optic Premises Distribution Cable.

w) ANSI/ICEA S-87-640-2000, Fiber Optic Outside Plant Communications Cable.

x) ANSI/TIA/EIA-526-7-1998, Optical Power Loss Measurements of Installed Single-mode Fiber Cable Plant-OFSTP-7.

y) ANSI/TIA/EIA-526-14-A-1998, Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant-OFSTP-14A.

z) ANSI/TIA/EIA-598-A-1995, Optical Fiber Cable Color Coding.

aa) ANSI/TIA/EIA-604-3-1997, FOCIS 3 Fiber Optic Connector Intermateability Standard.

1.4 SUBMITTALS

A. Pre-construction material submittals

1. Whenever in the Contract Documents any materials, products, processes or articles are indicated or specified by the name brand of the manufacturer, or by patent or proprietary names, such specifications shall be deemed to be a measure of quality and utility or a standard, and shall be deemed to be followed by the words, “or equal”. It is the intent of this article to comply with Public Contract Code Section 3400.

B. Proposed Product Substitutions

1. All proposed product substitutions shall be requested as per Section Product

Substitution Procedures.

1.5 LOW VOLTAGE ENCLOSURES AND PATHWAYS

A. Minimum 1 1/4” conduit or as shown on plans.

B. Mounting hardware and anchors recommended by the Manufacturer of any material that shall be mounted to the building or structure.

1. Sheetrock/drywall/wall board: Easy Anchor, toggle bolt, other spread type anchor with load distribution, or approved equal.

2. Concrete/cinder block/solid masonry: expanding compression type lag, expanding compression type bolt, expanding compression type all tread with nuts, or approved equal.

3. Tile/Stucco/hollow masonry: toggle bolts or approved equal.

4. Wood: lags, wood screws, or approved equal.

5. Metal: clamp, or approved equal.

C. Cover plates will be Panduit with four ports (minimum). Blanks will be used to cover any unused ports.

D. Definitions:

1. A rack is defined as a sideless, bottomless, topless open-rammed support structure for equipment. A rack may be mounted to a wall, ceiling, or to a floor depending on type, size, and District requirements.

2. A cabinet is defined as an enclosed equipment support structure with opening front and rear. A cabinet may be mounted to a wall, or to a floor depending on type, size, and District requirements.

3. All cabinets and swing able racks must be able to open fully with no cable tension, or obstructions.

E. Nomenclature:

1. IDF cabinets are cabinets/racks specified for intermediate distribution frames, typically at the head of a wing and feed one or more classrooms. Typically a Chatsworth (36Hx24Wx24D or 48Hx24Wx24D).

2. MDF cabinets are cabinets/racks specified for main distribution frames. Typically 84” high.

3. All equipment shall be mounted with Phillips screws, unless otherwise specified.

PART 2 - PRODUCTS

2.1 DATA

A. 4-pair 24 AWG Category 6A cable (Data) shall test at 1Gbps. Data cable shall be blue in color. Approved manufacturers are Berktek and General Cable.

B. All Category 6A jacks shall in Panduit and blue in color for data (p/n CJ688TGOR).

C. Category 6A patch panels shall be Panduit Modular Patch Panel (p/n CPP48FMWBLY) loaded with 48 Category 6A RJ45 jacks. Jacks shall be Panduit CJ688TGOR.

D. Wire management will be Panduit Horizontal Cable Management System (p/n NCMH2).

E. New Single Mode fiber optic cable shall be OM4, tight buffered, 8.3/125 microns. Approved manufacturer's are OCC and Berk-Tek. No composite cable shall be used.

F. Fiber Optic connectors will be Panduit (or equivalent) LC connectors.

G. Fiber enclosures shall be mounted at the top of the cabinet/rack.

H. The fiber enclosures for the MDF shall be rack mountable with applicable number of LC duplex port connector outlets for termination of all fiber runs (12 strands per IDF). The fiber enclosure for the MDF shall be sized such that the initial installation does not exceed 60% of its capacity. The MDF fiber enclosures shall be Panduit 72 port 19" rack mount (p/n FRME4), loaded with the appropriate number of 6 strand fiber adapter panels (p/n FAP3WEIDSC).

I. The fiber enclosures for the IDF shall be rack mountable with applicable number of LC duplex port connector outlets for termination of all fiber runs (6 strands per CIDF and 12 strands to MDF). The fiber enclosure for the IDF shall be sized such that the initial installation does not exceed 60% of its capacity. The IDF fiber enclosures shall be either the Panduit 72 port unit listed above, or the Panduit 54 port, 19" rack mounted unit (p/n FRME3) loaded with the appropriate number of 6 strand fiber adapter panels (FAP3WEIDSC).

J. Fiber patch cords shall be 1 meter, 2 meter, or 3 meters long, as required and shall be LC to LC connectors or LC to LC as required.

2.2 TELEPHONE/VOICE

A. Voice cable shall be blue in color. Approved manufacturers are Berk-Tek and General Cable.

B. All Category 6A jacks will be Panduit and blue in color for voice (P/n CJ688TGBU).

C. OSP gel/icky pick blocking kits for 25 pair and larger pair count cables shall be 3M Scotchcast 4416 duct sealing kit or approved equal.

2.1 Category 6A 66-blocks shall be Siemon or equal and include Siemon's "Lasting Hinge Cover" (P/n MN4LH-2) for labeling purposes.

PART 3 - EXECUTION

3.1 GENERAL REQUIRMENTS

A. The wiring of the system shall be executed in accordance with the drawings and the equipment manufacturer's wiring diagrams. Should any variations in these requirements occur, the contractor shall notify the Owner's Representative before making any changes. It shall be the responsibility of the manufacturer-authorized distributor of the approved equipment to install the equipment and guarantee the system to operate as per plans and specifications.

B. Furnish all conductors, equipment plugs, terminal strips, etc., and labor to install a complete and operable system.

C. Splices of conductors in underground pull boxes are not permitted.

D. The labor employed by the contractor shall be regularly employed in the installation and repair of communication systems and shall be acceptable to the Owner's Representative to engage in the installation and service of this system.

E. The contractor shall thoroughly clean all equipment and materials. All exposed parts of the equipment, cabinets, and other equipment shall be left in a clean condition, unblemished and free of all dirt, dust, smudges, spots, fingerprints, etc. The contractor shall remove all debris and rubbish occasioned by the electronic systems work from the site. The contractor shall thoroughly clean all buildings of any dirt, debris, rubbish, marks, etc., caused by the performance of this work.

F. The system must meet all local and other prevailing codes.

G. All cabling installations shall be performed by qualified technicians.

H. All cabling shall be splice free.

I. In order to ensure the least amount of cable untwisting, it is required that all cables shall be stripped using a special tool.

J. The use of lubricants (i.e. Blue 77) to facilitate the installation of cables in conduits is highly discouraged. If such a lubricant must be used, the contractor shall verify the acceptability of the lubricant to be used with the cable manufacturer, prior to using such a lubricant. Lubricants that harden after installation are not allowed.

K. Under no circumstance are "channel locks" or other pliers to be used.

L. Plenum rated cable may be run exposed above ceilings, provided the cabling is supported independent of other utilities such as conduits, pipes, and the ceiling support systems. The cable shall not be laid directly on the ciling panels. The use of cable ties shall be done in accordance with the cable manufacturer's requirements. The cable jacket composition must meet local and all other prevailing fire and safety codes.

M. All firewalls penetrated by structured cabling shall be sealed by use of a non-permanent fire blanket or other method in compliance with the current edition of national Fire Protection Association (NFPA) and the National Electric Code (NEC) or other prevailing code. The

contractor must not use concrete or other non-removable substance for fire stopping on cable trays, wire ways or conduits.

N. Site Cleaning. Throughout the progress of the plant construction, the contractor shall keep the working area free from debris of all types and remove from the premises all rubbish resulting from any work done by Contractor. On a daily basis and at the completion of its work the Contractor shall, to the extent possible, leave the premises in a clean and finished condition.

O. Conduits. All backbone cabling will run through dedicated conduits. All new conduits will be supplied with a pull string. Contractor shall supply pull string and pull rope for the installation of all cables in existing conduits. For all conduits left with available capacity, Contractor shall replace pull strings with ¼-inch pull rope during the course of his work. Contractor must seal all conduits with an approved sealing compound.

P. Cabling and Termination Identifications. All new cabling shall be of the type specified herein. Any conflicts between cabling types specified and code or design requirements shall be submitted to Owner's Representative for review and final disposition. All cabling shall be neatly laced, dressed and adequately supported. Cabling must be concealed to the fullest extent possible. In addition, a numbering and marking scheme must be used to identify all cable and cabling terminations. All cables, regardless of length, shall be marked and/or numbered at both ends. Marking codes and methodologies shall correspond to the instructions in this specification.

Q. Seismic Requirements. Contractor will install all equipment racks, equipment cabinet enclosures, cable runways, etc. according to the local, state and/or federal code. Contractor will notify Owner's Representative of such requirements and shall provide such bracing as required.

R. Safety Requirements. Contractor will utilize appropriate personnel and display warning signs, signals, flags and/or barricades at the work site to ensure adherence to safety regulations and as prudence requires.

S. Owner or Owner's Representative may view work or testing in progress.

3.2 CABLE ROUTING

A. The cables will be routed to their respective Main Distribution Frame (MDF), Intermediate Distribution Frame (IDF), or to service drop utilizing the shortest path possible.

B. Cable shall not be exposed at any point in the cable path. Contractor is to use appropriate pathway for the situation (i.e. inside wall, conduit, or non metallic surface raceway). EXCEPTION: In MDF ROOM ONLY cables may be exposed and routed in contractor supplied D-rings every 4 feet.

C. Cables shall be protected and sleeved with a conduit in locations where cables need to pass through walls, floors, or hard ceilings. Contractor shall install threaded IMC or rigid conduit with large fender washers, lock rings, and screw on protective bushings on both ends. The fire rating of the wall must be maintained during and after installation.

D. At solid wall location such as plaster, brick, concrete, cinder block, tile, reinforced concrete, Contractor will provide and install surface mounted non-metallic raceways or equivalent.

The use of different series raceways is required at locations where cable fill capacities are exceeded.

E. Terminations on block walls will be accomplished with District approved surface mount boxes.

F. Cables will be run vertically inside the wall and into the ceiling space. Terminations on stud walls will be accomplished with cut-in type electrical boxes with a 1" conduit (flex or EMT) extended from the box within the wall to ceiling access space.

G. Service loops:

1. Fiber:

a. Shall be a minimum of 10' at all MDF and IDF locations.

b. Shall be a minimum of 6' at all ground box locations that allow for the minimum bend radius specified by the manufacturer.

2. Category 6A (Data and Voice) and CATV/Broadband

a. Shall be a minimum of 6' at all MDF and IDF locations.

b. Shall be a minimum of 6' at all ground box locations that allow for the minimum bend radius specified by the manufacturer.

3. Category 6A Voice Feeder Cables

a. Shall be routed around the perimeter of the backboard in which it is terminated on.

b. All ground boxes shall have a minimum of 6' service loop.

H. Cables shall be run in corridors wherever possible in order to avoid furniture and work areas so that access to the cables in unencumbered.

I. The cables are to be as accessible as possible, placed above all other items in the ceiling, including ducts and supports.

J. Do not use pulling means, including fish tape, cable or rope, which can damage the Wiremold raceway.

K. Use pulling compound or lubricant that will not deteriorate cable or conduit.

L. Pulling compound shall be a water base pulling lubricant that will not deteriorate cable or conduit.

M. Cables shall not be pulled across sharp edges. If sharp edges are present a small sleeve, insuliner or grommet shall be installed to protect the cable.

N. Cables shall be pulled free of sharp bends or kinks.

O. Cables shall not be forced or jammed between metal parts, assemblies, etc.

P. Cables shall not be pulled across access doors and pull box covers. Access to all equipment and systems shall be maintained.

Q. Manufacturer's specifications for pulling stress and minimum bend radius shall not be exceeded on any cable.

R. Do not use staples or drive rings.

3.3 CABLE INSTALLATION PARAMETERS

A. Contractor is required to adhere to the following parameters in this section whether or not existing equipment has been placed by Contractor and/or others.

B. Contractor will notify District of any of the following requirements that cannot be met prior to bid.

C. Data UTP specifications.

1. Data terminations shall be T568B configuration unless otherwise specified

2. Category 6A modular patch panels shall be installed in accordance with manufacturer's design and installation guidelines.

3. Data UTP Testing

a. All data UTP cable shall be tested after installation according to the procedures and acceptability criteria described in EIA/TIA Standards for Category 6A cable and connecting hardware. Test at level 11 compliance.

b. Data UTP cable shall meet or exceed requirements for 1 Gbps data transmission.

c. Network certification of all four (4) pair will meet testing criteria for a minimum of 1000BASE-TX

d. Printed test results (both printed copy and data file copy) shall be provided as documentation of the quality of installation procedures and as a baseline for future troubleshooting.

e. All UTP testing equipment shall have current calibration certification.

D. Fiber Cable Specification

1. Fiber cable will be multi-mode 50 micron rated at OM4. The number of strands will be specified by the District. Contractor will provide a specification sheet for the cable they will be using on each job.

2. Fiber Optics Connectors

a. All connectors shall be glass-in-ceramic LC to LC connectors.

3. Fiber Optics Cable Installation and Testing

a. All spare optical ports and connectors shall have a dust cap in place to protect from

the environment.

b. Contractor shall provide and install blanks in unused spaces of the fiber enclosure.

c. If fiber is supplied to Contractor by the District it shall be tested before installation, while still on the shipping reel, using and optical time domain reflectometer (OTDR).

d. The test results shall be compared to the manufacturers test results. A discrepancy of more than 1 dB on any fiber in either window indicates possible shipping damage and the fiber shall be returned to the supplier.

e. The test results shall be maintained in a file for future reference.

f. All fiber shall be tested after installation according to the procedures and acceptability criteria described in EIA/TIA 455A (Aug 1991) and all applicable addenda after installation and an 1310/1550 nm power meter and stabilized light source for single mode fiber. OTDR testing is to be performed in any location where the fiber is not continuous, i.e. coupled LC connectors (soft splice), fusion splice and mechanical splice.

g. The results of these tests (printed OTDR result power meter attenuation results) shall be provided by the installer as documentation of the quality of installation and as a baseline for future troubleshooting, both printed copy and data file copy.

h. The results shall be compared to the pre-installation test results for significant changes.

i. All optical test equipment shall have current, traceable calibration certification.

k. The multi-mode cable shall comply with the following maximum individual fiber loss (cabled): Attenuation 1310 nm, 2.00 dB end to end (basic link) 1550 nm, 1.00 dB end to end (basic link).

l. Aerial fiber cable mounting hardware shall be matched to the all supporting (ADSS) fiber cable exactly and be installed in accordance with mounting hardware and cabling manufacturers specifications.

E A maximum fill capacity of 40% will be deemed acceptable for conduits and 75% of raceway and surface mold. Contractor shall inform Consultant in writing if this requirement cannot be met. If the Contractor fails to inform the Consultant any labor involved in rerouting cables in such conduit or raceways shall be the soul responsibility of the Contractor.

F. Cable shall be identified with a machine-printed tag identifying the system type in all access points (i.e. junction boxes, ground boxes, MDF, IDF's, etc.) and as they enter or exit the conduit pathway.

G. Contractor will assess whether or not the ceiling space is a plenum air return which shall dictate the use of the listed plenum type or PVC type cable required in the materials specification section. Any cable installations that shall be pulled through underground conduit will require Outside Plant (OSP) cable.

H. All cabling shall be installed with proper stress relief and tied down.

I. Manufacturer's specification for pulling stress and minimum bend radius shall not be exceeded on any fiber optic, data, voice, CATV, CCTV, IP Network Cameras, PA or any other cable.

J. Power feeds of greater than 220 volts shall not be run parallel to the UTP cables. Parallel runs of greater than 20 feet require a minimum separation distance of 3 feet, or 18 inches if cables are contained in a metallic conduit, which is grounded.

K. Multiple conduit runs of 110 volts power distribution shall not be run parallel to the UTP cables. Parallel runs of greater than 20 feet require a minimum separation distance of 18 inches.

L. All power feeds crossing the path of the UTP cables at right angles shall be a minimum of 6 inches in distance from the UTP cables.

M. There shall be an 18 inch separation between the cables and the fluorescent light fixtures. Contractor shall notify District representative in the event this requirement can not be met.

N. All cable/cabling shall be kept 30 inches away from any heat source; i.e., HVAC ducting, steam valves, etc.

O. Thin Ethernet or Fiber Optic cable/cables shall be identified with a tag as to the system and date, every 30 feet when installed in open trays or suspension systems in ceilings.

P. Station Cable (UTP) or STP runs are not to exceed 295 feet for data and 1000 feet for voice.

Q. Cable splicing at any point of a UTP or STP station cable or any cable installed by the contractor is unacceptable without specific district approval.

R. No cabling is allowed to rest on any ceiling tile or suspension system unless specifically authorized by District. Strapping or mounted to any existing wires (e.g., lighting, ceiling grid, etc.) is not permitted.

S. Cables shall be securely supported to building structure (i.e. stud, beam, or other framing member) within 12 inches of any conduit or raceway entrance.

T. Contractor will place all station cables in the ceiling area on Contractor supplied and installed wire hangers or in floor spaces and raceways.

U. Insulation shall be removed to expose shielding and conductors/fibers to the exact length required by manufacturer for proper termination of plugs, pins and fiber terminations.

1. Wires and shielding shall not be nicked or damaged in any way upon termination of pins and closure of plug assembly.

2. Pins and plugs, upon termination, shall not be damaged in any way.

3.4 LABELING AND IDENTIFICATION

A. All cable plant labeling and administration documentation shall conform to ANSI/TIA/EIA 606 Administration Standard.

B. The cables within the rack or cabinets shall be numbered for identification.

C. Equipment used for labeling shall be: Brother “P-Touch” model PT-1750. Label media shall be black typeface on white tape. Tape material shall be ½” wide.

D. Components shall be marked where they are administrated (label at all punch down points, panels, blocks, outlets, etc.).

E. Industry standard color fields should be used where applicable as described in the Standards.

F. All pathways labeled (conduit, trays, etc.).

G. Data UTP Labeling

1. Wiring termination locations shall be labeled to corresponding pairs at the MDF, IDF, CIDF and at each workstation end.

2. Cables shall be labeled no more than 3” back from each end of the termination point with a cable label that matches the faceplate labeling.

3. Contractor will provide tags, straps and adhesive labels. These tags, straps and adhesive labels shall be of high quality that will endure over time.

4. Hand written labels are not acceptable.

5. Each drop shall have a unique label throughout the site. This would allow a cable management system to track each cable pair.

6. Labeling Scheme:

H. Workstation Labeling: The faceplate or surface block shall be labeled with the Room # of the IDF where the cable sources from, the Room # the cable terminates in, and the sequential workstation number (ex. B10(IDF)-B2(RJ45 jack)-09(Workstation number). Each room shall have a sequential workstation number starting with the number 01 (ex. B10-B2-01 through B10-B2-10 and B10-B3-01 through B10-B3-10). The labeling itself shall be in a white background with black lettering.

I. Closet Labeling: Patch panel shall be labeled with the Room # the cable terminates in (RJ45 jack) and sequential workstation number only. The labeling itself shall be in a black background with white lettering.

J. Data Fiber Optics Labeling

1. Fiber termination locations shall be labeled to corresponding fiber strands pairs at the MDF, IDF, and CIDF.

2. The labeling scheme will be provided by the District and will be specific up to and including instructions for the placement of labeling, tags, straps, and adhesive labels.

3. Contractor is expected to provide tags, straps and adhesive labels. These tags, straps and adhesive labels shall be of high quality that will endure over time.

4. Hand written labels are not acceptable.

5. Labeling Scheme:

   i) Each drop shall have a unique label throughout the site. This would allow a cable management system to track each cable.

   ii) Cables shall be labeled approximately 12 inches back from the point where the cable enters the fiber enclosure with a cable label that identifies the origin and destination of the cable.

   iii) Closet labeling; each connection shall be labeled denoting each strands color, origin and destination with name of room or wing.

   iv) The type (single-mode or multi-mode) of fiber optic cable used shall be clearly labeled on the fiber patch panel per drawn details.

   v) Color-coding shall conform to EIA/TIA specifications.

3.5 TESTING OF THE CABLING PLANT

A. Contractor is responsible for supplying all of the required test equipment used to conduct acceptance tests.

B. District reserves the right to be present during any or all of testing.

C. All cabling not tested strictly in accordance with these procedures shall be re-tested at no additional cost to the District.

D. 100% of the installed cabling must be tested. All tests must pass acceptance.

E. Test equipment shall be fully charged prior to each day's testing.

F. Test reports must be submitted in hardcopy or electronic format. Hand-written test reports are not acceptable.

G. Hardcopy reports are to be submitted in labeled 3 ring binders with an attached affidavit verifying passing execution of all tests. For large installations electronic reports with hardcopy summaries are preferred. Hardcopy summary reports shall contain the following information on each row of the report: circuit ID, test specification used, length, date of test, and pass/fail result.

H. Electronic reports are to be submitted on CD format. If proprietary software is used, CD shall contain any necessary software required to view test results. If the results are delivered in a standard format like Excel, Access, CSV files, etc. then software to read these files are not provided. Electronic reports must be accompanied by a Certificate signed by an authorized representative of the Contractor warranting the truth and accuracy of the electronic report. Certificate must reference traceable circuit numbers

that match the electronic record.

I. Test reports shall include the following information for each cabling element tested:

1. Wire map results that indicate the cabling has no shorts, opens, miswires, split, reversed, or crossed pairs, and end to end connectivity is achieved.

2. For Category 6A cabling: Attenuation, NEXT, PSNEXT, Return Loss, ELFEXT, and PSELFEXT data that indicate the worst case result, the frequency at which it occurs, the limit at that point, and the margin. These tests shall be performed in a swept frequency manner from 1 MHz to highest relevant frequency, using a swept frequency interval that is consistent with TIA and ISO requirements. Information shall be provided for all pairs or pair combinations and in both directions when required by the appropriate standards. Any individual test that fails the relevant performance specification shall be marked as a FAIL.

3. Length (in meters), propagation delay, and delay skew relative to the relevant limit. Any individual test that fails the relevant performance specification shall be marked as a FAIL.

4. Cable manufacturer, cable model number/type, and NVP

5. Tester manufacturer, model, serial number, hardware version, and software version

6. Circuit ID number and project name

7. Auto-test specification used

8. Overall pass/fail indication

9. Date of test

10. Test reports shall be submitted within 7 business days of completion of testing.

3.6 TEST EQUIPMENT

A. Test equipment used under this contract shall be from manufacturers that have a minimum of 5 years experience in producing field test equipment. Manufacturers must be ISO 9001 certified.

B. All test tools of a given type shall be from the same manufacturer, and have ompatible electronic results output.

C. Test adapter cables must be approved by the manufacturer of the test equipment. Adapters from other sources are not acceptable.

D. Baseline accuracy of the test equipment must exceed TIA Level III, as indicated by independent laboratory testing.

E. Test equipment must be capable of certifying Category 6A and 6 links.

F. Test equipment must have a dynamic range of at least 100 dB to minimize measurement uncertainty.

G. Test equipment must be capable of storing full frequency sweep data for all tests and printing color graphical reports for all swept measurements.

H. Test equipment must include S-Band time domain diagnostics for NEXT and return loss (TDNXT and TDRL) for accurate and efficient troubleshooting.

I. Test equipment must be capable of running individual NEXT, return loss, etc measurements in addition to auto-tests. Individual tests increase productivity when diagnosing faults.

J. Test equipment must include a library of cable types, sorted by major manufacturer.

K. Test equipment must store at least 1000 Category 6A or 6 auto-tests in internal memory.

L. Test equipment must be able to internally group auto-tests and cables in project folders for good records management.

M. Test equipment must include DSP technology for support of advanced measurements.

N. Test equipment must make swept frequency measurements in compliance with TIA standards.

O. The measurement reference plane of the test equipment shall start immediately at the output of the test equipment interface connector. There shall not be a time domain dead zone of any distance that excludes any part of the link from the measurement.

3.7 MDF/IDF/CIDF INSTALLATION PARAMETERS

A. UTP cabling shall conform to a 6 foot separation requirement from main power panels, Switch gear and/or starter motors adjacent to the IDF and termination locations.

B. All data, voice and communications racks and cabinets shall be anchored in accordance with manufacturer specifications and drawn details, to walls and floors and grounded to building ground grid (not to water pipes, etc.). Individual or new ground points are acceptable.

C. All floor mounted racks and cabinets shall have ladder racking from top of rack or cabinet to nearest wall as directed by consultant.

D. Wall mounted racks and cabinets.

1. Backboards shall be made of fire retardant or treated materials. Outside backboards shall be mounted squarely cut, with sanded edges, void free and painted. Backboards made from particle or pressed board materials are not acceptable. Backboards shall be a minimum size of ¾" thick x 36" wide x the height of the rack or cabinet. Backboard shall be painted with white fire-retardant paint.

2. Inside backboards shall be mounted squarely cut, with sanded edges and void free. Inside backboard shall match the inside dimensions of the installed cabinet. Inside backboard shall be a minimum thickness of ¾".

3. All new racks and cabinets shall be securely mounted to wall studs in accordance with

manufacturer specifications and drawn details.

E. All new and existing racks and cabinets shall have a dedicated 110V/AC double duplex outlet installed per specification section, California Electrical Codes, and drawing details.

3.8 DOCUMENTATION AND DRAWINGS

A. As a pre-requisite for the acceptance of the work, the Contractor shall provide all of the following information. The Contractor shall prepare and provide 2 copies of a complete Cable Book as documentation. This cable book shall consist of the following:

1. Title of Project

2. Index page detailing the following sections

3. Site plans (as-built drawings)

4. Drawings shall be professionally drafted (to scale, within a border similar to design drawings) and reproducible. Hand written drawings are not acceptable.

5. The drawings shall depict, at a minimum, the following conditions:

a. The exact MDF/IDF/CIDF locations

b. Size and routing of backbone cable from each IDF to the MDF.

c. Station locations and their exact labeling ID(s) which shall match the physical label at the device.

d. New pathways, conduit, ground boxes, junction boxes, raceway, power poles and floor monuments.

e. Any other new conditions.

6. Contractor shall provide 3 sets of as-built drawings, one of which shall be reproducible.

7. In addition to the hard copy requirements, the as-builts, one of which shall be generated on Visio, and supplied to District. Media shall be recordable CD.

8. The Contractor shall submit as-built drawings and media no later than 30 days after the installation date.

9. Price list and contact information for emergency service work.

B. Fiber backbone test results

1. In sequential order by IDF number

C. Data station cable test results

1. In sequential order by IDF and then drop number.

D. Voice feeder test results.

1. In sequential order by IDF number.

2. Station/Feeder connectivity spread sheet (8-1/2" x 11" hard copy and electronic file, Microsoft Excel format).

E. Voice station cable test results.

1. In sequential order by IDF number.

2. Station/Feeder connectivity spread sheet (8-1/2" x 11"hard copy and electronic file, Microsoft Excel format).

F. Warranty certificates and documentation.

3.9 WARRANTY AND SUPPORT SERVICE

A. The warranty shall commence from the date of final written acceptance by the Owner.

B. All conditions for obtaining the manufacturer's Performance Warranty shall be the sole responsibility of the contractor.

C. The contractor shall maintain a competent service organization and shall, if requested, submit a service maintenance agreement to the owner after the end of the guarantee period.

D. A typewritten notice shall be posted at the equipment rack that shall indicate the firm, address and telephone number to call when service is necessary. The notice shall be mounted in a neatly finished metal frame with a clear plastic window and securely attached to the inside of the door.

E. Extended Product Warranty and Application Assurance:

1. The 25 Year Extended Product Warranty shall ensure against product defects, that all approved cabling components exceed the specifications of TIA/EIA 568A and ISO/IEC IS 11801, exceed the attenuation and NEXT requirements of TIA/EIA TSB 67 and ISO/IEC IS 11801 for cabling links/channels, that the installation will exceed the loss and bandwidth requirements of TIA/EIA TSB 67 and ISO/IEC IS 11801 for fiber links/channels, for a twenty (20) year period. The warranty shall apply to all passive SCS components. The 20 Year Extended Product Warranty shall cover the replacement or repair of defective product(s) and labor for the replacement or repair of such defective product(s) for a twenty (20) year period.

2. The 25 Year Application Assurance shall cover the failure of the wiring system to support the application which it was designed to support, as well as additional application(s) introduced in the future, up to 1000 Mbps parallel transmission schemes, by recognized standards or user forums that use the TIA/EIA-568A or ISO/IEC IS 11801 component and link/channel specifications for cabling, for a twenty (20) year period.

3. Upon successful completion of the installation and subsequent inspection, the Owner's Project Manager shall be provided with a numbered certificate, from the manufacturing company, registering the installation

F. One-Year Maintenance Service shall be provided as follows:

1. Emergency Response: Contractor must respond by utilizing remote diagnostics capabilities (as applicable) within thirty minutes of notification. If necessary, Contractor must dispatch at least one certified technician for arrival on-site within two hours of notification.

2. Non-Emergency Response: Contractor shall respond by utilizing remote diagnostics capabilities and or cause dispatch of at least one certified technician for arrival on-site within one business day of notification.

3. Definition of "Emergency": For maintenance purposes, "emergency" shall be defined as one or more of the following conditions:

a. Defects of any riser pairs and/or components involving at least ten percent (10%) of any riser cable's capacity.

b. Defects of station cable pairs and/or components involving at least ten percent (10%) of any department or group of voice and/or data stations.

c. Defects significantly impairing any single attendant console.

d. Defects of any fiber optic cable and/or components involving at least ten percent (10%) of any departments or groups fiber-based systems and/or stations.

e. Any pre-defined failure as submitted by Owner and agreed to by Contractor.

G. Contractor shall provide extra service upon request on a 24 hour-a-day, 365 day-a-Year basis. Pricing for such service shall be described in the "Cable Book" Documentation.

3.10 FINAL ACCEPTANCE

A. The Owner or Owner's representative may visit the site during the installation of the system to ensure that correct installation practices are being followed.

B. The Owner or Owner's representative will conduct a final job review once the contractor has finished the job. The review will take place within one week after the contractor notifies the owner.

C. Two copies of all certification data and drawings for all identifications shall be provided to the Owner before the Owner's review.

D. The Owner or Owner's representative will review the installation and certification data prior to the system acceptance.

E. The Owner or Owner's representative may test some of the systems features to ensure that the certification data is correct. If a substantial discrepancy is found, the Owner reserves the right to have an independent consultant perform a certification of the entire system. If such a procedure is undertaken, the cost of the testing will be billed back to the contractor.

F. In the event that repairs or adjustments are necessary, the contractor shall make these repairs at his own expense. All repairs shall be completed within 10 days from the time they are discovered.

END OF SECTION

SECTION 27 41 16
AUDIO VIDEO SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY:

A. Section Includes: Services as listed herein and related to the furnishing, installation, and commissioning of audio, video and communications equipment.

B. Related Documents: The Conditions of the Contract and Division 01 – General Requirements apply to this section as fully as if repeated herein.

C. Related Sections: Coordinate with the following sections in carrying out this work:

1. Division 26 – Electrical

2. Division 27 - Communications

1.2 REFERENCES:

A. Comply with all national, state and local regulations and the procedures and requirements of the local authorities. In the event of conflict between these specifications and the applicable regulations, the more stringent shall govern.

B. Equipment shall be provided in accordance with the related trade and regulatory guidelines including but not limited to UL/ETL, NEC, IEEE, and all manufacturer's recommendations and requirements. Contractor shall be responsible if work under their control voids or jeopardizes manufacturers' warranties.

C. Labor shall be provided in accordance with applicable labor regulations and practices.

D. Reference Standards

1. Provide the most current AV and associated industry standards. Standards organizations include, but are not limited to:

a. AES – Audio Engineering Society

b. ANSI – American National Standards Institute

c. AVIXA (Infocomm) – Audiovisual and Integrated Experience Association

d. CEA – Consumer Electronics Association

e. EIA – Electronics Industries Association of America

f. ICEA – Insulated Cable Engineers Association

g. IEC – International Electrotechnical Commission

h. IEEE – Institute of Electrical and Electronics Engineers

i. ISO – International Organization for Standardization

j. NARA – US National Archives and Records Administration

k. NCTA – National Cable and Telecommunications Association

l. NEC – National Electrical Code

m. NFPA – National Fire Protection Association

n. SMPTE – Society of Motion Pictures and Television Engineers

o. TIA – Telecommunications Industry Association

p. UL – Underwriter Laboratories Incorporated

1.3 DEFINITIONS:

A. Refer to the General Conditions for definitions.

B. Architect: For the scope in this Section, authorized personnel representing Owner and the Theater Consultant.

C. Contractor: Contractor/Manufacturer responsible for the work of this section. Note: Where work relates to other trades, the trade will be identified by name preceding the word contractor or by the associated division.

D. Owner: Authorized personnel representing the ultimate occupant of the completed project site. Also: Client; User; Operator.

E. Install: Integrate into proper location on the project site.

F. Provide: Furnish and install, unless otherwise noted

G. Technical Definitions:

1. SDI - Serial Digital Interface (HD- resolutions up to 4:2:2 10-bit 1080p30; 3G- resolutions up to 4:2:2 10-bit 1080p60; 6G- Resolutions up to 4:2:2 10-bit 4K-UHD including 4:4:4 10-bit 1080p60; 12G- resolutions up to 4:2:2 12-bit 4K-UHD including 4:4:4 10-bit 4K-UHD p60)

2. 4K-DCI- 17:9 Digital Cinema 4K resolution at 4096x2160

3. 4K-UHD-Computer/Video UHD resolution at 3840x2160

4. AFF - Above Finished Floor
5. ALS - Assistive Listening System
6. ASM - Assistant Stage Manager
7. AV - Audiovisual
8. A/R - As Required
9. BYOD- Bring your own device
10. CAT - Category (i.e., Category 5e, 6, 6a, 7, etc.)
11. CATV - Cable Television or Community Antenna Television
12. CC - Closed Captions
13. CCU - Camera Control Unit
14. CFCI - Contractor-Furnished Contractor-Installed
15. CTRL- Control
16. DI - Direct Injection Box
17. DP - DisplayPort
18. DSP - Digital Signal Processor
19. EAE - Electro-acoustic Enhancement
20. HD - High Definition
21. HDMI - High Definition Multimedia Interface
22. I/O - Inputs/Outputs
23. MATV- Master Antenna Television
24. MIX - Sound Operator Position
25. MM - Multimode (Fiberoptics)
26. MPEG-Moving Picture Experts Group
27. OC - Open Captions
28. OFCI - Owner-furnished Contractor-Installed

29. OFOI - Owner-furnished Owner-Installed
30. RF - Radio Frequency
31. RX - Receiver
32. SD - Standard Definition
33. SM - Singlemode (fiberoptics); or Stage Manager (Production)
34. TD - Technical Director
35. TX - Transmitter
36. USB - Universal Serial Bus
37. UPS - Uninterruptible Power Supply
38. VIF - Verify in Field

1.4 SYSTEM DESCRIPTION:

A. Commons

1. Audio

a. The Commons system is comprised of a left/right pair of main column-style loudspeakers. Loudspeakers & rigging shall be white in color.

b. An automixer/DSP unit shall be provided for control over the room audio system.

c. All DSP programming is the responsibility of the AV contractor.

d. Provide input/output to the DSP control. Connect contact closure from Fire Alarm Control Panel (FACP) to the audio system to mute the system when alarm is active.

e. A dual-channel wireless mic system, with handheld transmitters, antenna combiner and antennas shall be provided.

f. An ADA-compliant FM-based assistive listening system shall be provided. Owner will be providing existing receivers and headphones.

2. Video Projection System

a. A production video switcher and scaler shall be provided to handle signals from all video devices, including remote laptop computer inputs, & and other inputs as indicated on the drawings. The remote laptop computer inputs shall use STP cable as their means of transport. The switcher shall be fully HDCP compliant and support EDID.

b. The video scaler shall be properly configured to accept any aspect ratio or resolution and modify the image for proper viewing on the projection screen. This function shall be automatic, and require no additional configuration from the user.

3. Provide 163” direct-view LED monitor with ERO protective coating, complete with mount and manufacturer-supplied installation and setup.

   a. Include override/manual slider control for LED wall brightness.

   b. Configure display control via the control system.

4. Control

   a. A touch screen based control system shall be provided for control over all applicable AV devices in the theatre.

   b. A 7” color touchscreen shall be provided in a locking enclosure at location shown on the drawings. Provide recessed mounting kit.

   c. All control system programming is the responsibility of the AV contractor, and shall be submitted during the shop drawing phase for approval.

5. Utility

   a. See architectural & electrical sheets for proper placement of AV devices.

   b. Fixed equipment shall mount in a dedicated AV equipment rack with locking front door. Provide sequencing power system as indicated in the equipment list.

   c. Mount all devices per approved drawings. Variance will require re-submittal for approval.

6. Control System Programming

   a. Touchpanels shall be configured with the most often-used device functions. Do not attempt to put every possible device function on the touchpanel.

   b. The touchpanel shall be configured be configured to work in two modes: manual and automatic.

      1) When in manual mode, all functions shall be “single function” buttons.

a) A password must be entered to access manual mode.

2) In manual mode, access to advanced controls shall be provided, such as:

a) Wireless Mic, Main System Volume

b) System On/Off

c) LED Wall On/Off/Mute

d) Other functions as required.

3) In Automatic mode, the system shall activate the appropriate macros to enable the system to power on in its most used state or preset. Automatic modes shall be "Presentation with Audio and Video" and "Presentation with Audio Only". In either event, the wireless microphones shall be active.

4) Volume controls for "program playback" and "mic level" shall be always accessible.

B. Network Configuration

1. Coordinate IP address ranges and assignments with the Owner's IT forces for all AV devices.

2. AV systems that operate on IP-based networks shall be properly configured, using manufacturer-recommended settings.

3. Unless otherwise noted in the Contract Documents, provide separate network switches and network architecture for each AV system network. If AV system networks are indicated as sharing network switches and associated architecture, each network shall be separated into one VLAN per sub-system.

4. It is within the scope of this section to fully coordinate with Owner's IT forces for proper network configuration, and to provide a properly designed, fully documented network system.

1.5 CURRENT TECHNOLOGY:

A. Only the most current hardware and software shall be provided. In no case will discontinued or superseded products be acceptable. If the manufacturer has developed and successfully released products that meet or exceed the criteria within this specification, the Contractor shall notify the Architect and submit the new product for review. If accepted, the products shall be provided at no additional cost to the Owner. Software upgrades and authorized support services for its proper integration into the system shall be provided at no cost to the Owner throughout the warranty period.

B. In the event of known product defaults or recall, the Contractor shall immediately notify the Architect and make immediate arrangements for remedy.

C. None of the stipulations herein shall be grounds for revision to the Project schedule.

D. See related procedures under Warranties in this Section.

1.6 SUBSTITUTIONS:

A. All requests for substitutions from the specified materials, assemblies or related services shall be submitted for review by Architect in accordance with Section 01 – Substitution Procedures. Requests shall be made in a timely fashion to not affect the Project schedule in either case of the substitution being accepted or rejected.

B. Documentation for the substitution shall be submitted with supporting material and shall including the related information for the item as specified so that equivalence can be demonstrated. The burden of proof rests solely upon the Contractor. The Architect shall be the sole evaluator of the fitness of the substitution.

C. All expenses related to the substitution including, but not be limited to, all fees and expenses incurred in the evaluation of the substitution, and any effect on the costs and schedule of other trades whether or not the substitution is accepted, shall be borne by the Contractor.

1.7 SUBMITTALS:

A. General:

1. If permitted under Section 01– Submittal Procedures, all submittals shall be made in electronic format.

   a. Files shall be in .pdf format and submitted electronically.

   b. Clearly indicate submittal number and description in the file name of the document.

   c. Each document shall be a separate file.

   d. Markups will be made electronically, and the submittal returned via electronic means.

2. Submittals shall be made in a timely fashion so as to not affect the Project schedule and shall allow for adequate time for review and resubmittal. Partial submittals will not be acceptable and will be returned without review.

3. Submittals shall be reviewed, and field dimensions verified prior to commencing acquisition for, and fabrication of the Work in this section. All services and parts of the work in this section shall be verified through the submittal process.

4. Acceptance of any submitted data or shop drawings for material, equipment, apparatus, devices, arrangement and layout shall not relieve contractor from responsibility of furnishing same of proper dimensions and weight, capacities, sizes, quantity, and installation details to perform efficiently the requirements and intents of the systems design. Such acceptance shall not relieve the contractor from responsibility for error, omissions or inadequacies of any sort on submitted data or shop drawings.

5. Copies of contract drawings will not be accepted as shop drawings and will be returned without review.

B. Prior to commencing work on shop drawings, the contractor shall facilitate a meeting between the contractor and Architect and their consultant to “walk through” the AV systems.

C. Conduit, Backboxes and Electrical Systems Verification Letter:

1. Within 30 days of contract award, the AV contractor shall review all relevant information pertaining to the AV systems low-voltage conduit, backboxes, and line voltage electrical work to be performed by Division 26. A formal memo, indicating acceptance (or desired changes) of the Contract Drawings shall be provided. Failure to provide this memo indicates acceptance of, and liability for, the conduit, backboxes and electrical systems as indicated in the Contract Drawings.

    a. Coordinate conduit/wire routing, sizing, and quantities with Division 26. Routing shall be designed to minimize overall conduit/wire length. Refer to industry and manufacturer requirements regarding maximum wire length for all AV systems and indicated operating formats. Submit RFI’s for any wire/conduit runs that are anticipated to be over recommended maximum lengths. If installed lengths exceed maximum wire length recommendations, the Contractor is required to provide alternative infrastructure or equipment to meet the AV systems operational requirements.

2. If the contractor chooses to exercise the option to place conduit in-slab and on-grade or under-slab and in-grade, the contractor shall submit a revised AV conduit riser with new conduit size calculations using cables from the “wet-rated” AV cable schedule. See section 260535 for additional information

D. Shop Drawings:

1. Submit full-size (minimum 30” x 42”) scaled shop drawings that show the following:

    a. Installation requirements and mounting conditions.

b. Provide stamped structural drawings by a structural engineer licensed in the state in which the project takes place showing complete mounting details for all AV devices over 20 pounds.

c. Full system riser diagram(s) illustrating interconnection of system components, wiring requirements, back box sizes and any special installation considerations.

d. Block diagrams, showing equipment interconnection.

e. Equipment rack and patchpanel drawings.

f. Full-scale drawings of custom plates.

g. Run sheets or field wiring drawings.

h. Equipment modification drawings, including statement of purpose for modification and agreement to provide full manufacturer warranty, if modifications cause a voided warranty.

i. Final schematic drawings of any custom circuitry.

E. AV Control System Touchpanels:

1. Provide a hosted web link for approval of working touchpanel files.

a. This generally requires the contractor to setup and host an active control system processor, with a secure web link to allow remote parties to view & control.

2. The AV contractor is responsible for design of touchpanel layouts, but shall be subject to consultant and Architect approval.

a. If the organization has an existing template, the AV contractor shall use that template and modify as needed to suit the project.

F. Product Data:

1. Submit a detailed equipment list, including manufacturer, model number, description and quantity for each item.

2. Do not submit equipment cut sheets, except for custom or non-standard devices.

G. Color Data:

1. Submit spreadsheet with color schedule for all equipment and devices, including custom plates, speakers, racks, furniture, etc. Room name and number shall be listed.

2. Show standard color options to allow design team to select.

3. Where no option for color is available, indicate as much.

H. DSP Programming:

   a. Internal DSP programming (submit as software file)

I. Samples:

1. Submit samples for review if requested. Samples may include, but are not limited to:

   a. Connector, panel and cable assemblies

   b. Panel finish samples

   c. Custom switch, button or similar assemblies

J. Record Documents: Submit record documents in accordance with Section 01.

1. At time of final acceptance, submit regulatory listings and certifications as required by prevailing building codes.

2. Submit electronic “as-builts” including:

   a. Shop drawings, product data, operations and instructions manuals for all products provided.

   b. Equipment list, with manufacturer, model number, and serial number for all installed devices.

   c. Electronic backup of control system programming.

   d. Electronic backup of DSP systems programming.

   e. Care and maintenance instructions, service line and online contacts.

   f. Warranty documents.

   g. Key list, showing the following for all keys in the system: device name and model number, system controlled, key model number or other replacement identifier, tech support number for equipment manufacture, and thumbnail picture of device.

3. Additionally, a USB thumb drive with all final configuration files for all system equipment (ie- control system, DSP system, etc.) shall be provided to the job site. The drive should be labeled and zip-tied inside the rear of the equipment rack.

1.8 WARRANTY:

A. Warranty shall provide coverage of material and product defects and assembly workmanship or installation for a period of two years following the date of acceptance by the Architect.

B. Items under warranty shall be serviced to the satisfaction of the Owner with 14 days of notification to the Contractor.

C. The Contractor shall bear all costs that arise because of the warranty claim when service time exceeds 14 days, including, but not limited to, the use of temporary replacement components, additional Owner staffing or overtime, shipping, cancelled uses or performances.

D. Activate all manufacturers' warranties in the name of the Owner, within one week of the date of acceptance.

E. Provide three return visits following system acceptance to fine tune or repair any items requested by the Owner:

1. 1 month following acceptance

2. 1 year following acceptance

3. 2 years following acceptance, prior to warranty expiration

1.9 QUALITY ASSURANCE:

A. Equipment in this Section shall be provided by specialty subcontractors and manufacturers meeting the qualifications listed herein.

B. Specialty subcontractor shall have been continuously engaged in the sales and integration of audio, video and communications equipment similar to that specified herein for a minimum of 10 years.

C. Specialty subcontractors shall have at time of bid, and continuously maintain throughout the project and warranty period, a low voltage Specialty Contractor's license appropriate for the work in this Section, and in the state in which the project takes place.

D. Specialty subcontractors shall employ field service technicians within a four-hour driving distance from the Project site.

E. Specialty subcontractors shall employ personnel with the following minimum certifications:

1. Avixa/Infocomm CTS-I Certification

2. Dante Level 3 Certification

3. QSC – QSYS Level 2 Certification

4. QSC – QSYS Control 201 Certification

5. Extron Control Professional Certification

6. Cisco Networks Professional Level Certification

F. All equipment shall be UL or ETL listed, or listed by UL-approved testing facilities, and bear the appropriate labels.

1.10 DELIVERY, STORAGE AND HANDLING:

A. Packing shall prevent damage to the equipment during transit. Costs to repair or replace all equipment damaged during the course of the contract services shall be borne by the Contractor.

B. Do not deliver materials in this Section until building is ready for installation. Contractor is responsible to properly sequence the work and to protect from damage during delivery, handling, storage and installation.

C. Contractor is responsible to coordinate and provide secure and protected storage as required for the execution of the Contract.

1. Devices shall not be delivered to the project site until the project is suitably clean and all adjacent finish work that may be painted or produce dust has been completed. The contract shall provide and maintain complete protection of all devices until the Project has been made available for occupancy by the Owner. The contractor shall thoroughly clean and remove any dirt or dust that infiltrates system components and be responsible for timely replacement of any damaged components.

2. Device labels and connectors shall be delivered with temporary dust and paint protection installed.

1.11 PROJECT CONDITIONS:

A. Defects in the field which may impact the work in this Section shall be reported to the Architect and corrected in accordance with the requirements of the applicable Section of Work prior to commencement of the Work in this Section.

1.12 MAINTENANCE:

A. Provide maintenance stock of User-serviceable components within the system. Maintenance stock shall be packaged in weather resistant box labeled “spare parts for AV system” and turned over to the Client at time of system commissioning.

B. Maintenance stock shall include:

1. Package of spare parts for User-serviceable portions of the AV System

2. In addition, provide:

    a. Five connectors of each type in the system.

    b. Six spare keys of each type in the system.

    c. 10% of other miscellaneous parts required to service and maintain systems

PART 2 - PRODUCTS

2.1 PRE-APPROVED SPECIALTY SUBCONTRACTORS

A. The following AV systems contractors are pre-approved to complete the work in this section:

Coda Technology Group
Attn: Mark Latimer
1370 Redwood Way, Suite C
Petaluma, CA 94954
Phone: (707) 795-3522

Diversified
Attn: Adam Lopez
3275 Edward Avenue
Santa Clara, CA 95054
Phone: (408) 969-1972

ICS Integration, Inc.
Attn: Mark Berlo
550 Parrott Street, Unit #40
San Jose, California 95112
Phone: (408) 491-6000

PCD, Inc.
Attn: John Rudolph
1032 Maxwell Drive
Santa Rosa, CA 95401
Phone: (707) 546-3633

B. All others shall submit qualifications for approval. In order to qualify, the contractor shall submit the following information to the Architect for review:

1. List of personnel who will be working on this Project, including skills, experience, and accreditations.

2. List of union affiliations, contractor licenses, and other applicable trade certifications.

3. List of projects completed within the past 5 years, with references. Provide phone and/or e-mail addresses for reference contacts.

4. Proof that at least 5 jobs in the past 5 years have a minimum contract value equal to or greater than the project listed herein, and are of similar type

5. Proof that all requirement of Section 1.10 – Quality Assurance are met.

2.2 MANUFACTURERS:

A. AV equipment in this Section shall be provided by specialty manufacturers providing products meeting the specifications herein.

B. Provide all equipment as listed in 274116-A, equipment list.

2.3 SYSTEMS:

A. Audio Systems General Requirements:

1. Grounding: All grounding in racks is the responsibility of the AV contractor. All devices shall be appropriately grounded to the isolated grounding system busbar.

2. Unbalanced Devices: Provide a balancing transformer for any unbalanced audio device, at both input and output.

3. Loudspeaker Rigging: All overhead loudspeaker rigging shall be reviewed and stamped by a licensed structural engineer working in the State in which the project takes place. The contractor is responsible to secure the structural stamp, including all expenses associated therein.

B. Video Systems General Requirements:

1. Per SMPTE requirements for SDI video. Refer to Contract Documents for SDI video standards requirements. Note – Assume a minimum format of 1080p59.94.

C. Modulated (CATV) Video Systems General Requirements:

1. Cable Distribution System: The cable distribution system shall consist of coaxial cables, user interfaces, signal taps, splitters, RF amplifiers, signal equalizers, power supplies, and ancillary hardware as required to meet the system requirements specified below.

2. The signal level of each channel at each TV outlet shall be +5 dBmV, plus or minus 3 dBmV.

3. The system shall meet the following minimum parameters at each TV outlet:

    a. Signal-To-Noise Ratio: 43 dB

    b. Cross Modulation: -46 dB

    c. Hum Modulation: -55 dB

    d. Return Loss: 14 dB

    e. Isolation (outlet-outlet): 24 dB

    f. Aural Carrier Level: 13 dB to 17 dB below visual

    g. Impedance: 75 ohm

2.4 MATERIALS:

A. All components supplied under this Section shall be new. Used or factory reconditioned components will not be acceptable.

B. Cabling

1. Provide cabling as indicated in the drawings.

C. Wall-Mounted Swing-Out 19” Equipment Rack

1. Provide Middle Atlantic DWR Series.

2. Useable height shall be as required to fit equipment, useable depth shall be 26”.

3. 250 lb. weight capacity.

4. All structural elements shall be finished in black powder coat.

5. Rack shall be UL Listed.

6. Follow attachment methods as described in the drawings, which meet structural criteria provided by the project structural engineer.

7. Provide the following options:

    a. Solid Front Door with keylock, model #FD-xx.

    b. Custom rack mounts for equipment without rack ears, model #RSH-series.

    c. Other items as shown in the equipment list.

8. Provide the following for power management:

a. Provide rack-mounted power distribution & sequencing device as indicated in the equipment list.

9. Provide the following for thermal management:

a. Dual 6” fan kit with accessories, model #DWR-FK6-26. One per rack.

b. Thermostatic Fan Control, model #FC-4-1CA. One per rack.

c. Vent panels at bottom of rack, model VT-series. One per rack.

D. Connectors:

1. Microphone and Line Level Audio

a. XLR-M, 3-pin:

1) For panel-mount, Provide Neutrik NC3MD-L-1, 3-pole male XLR connector in black.

2) For cable-end, provide Neutrik NC3MXX, 3-pole male connector.

b. XLR-F, 3-pin, Standard

1) For panel-mount, Provide Neutrik NC3FD-L-1, 3-pole female XLR connector in black.

2) For cable-end, provide Neutrik NC3FXX, 3-pole female connector.

c. XLR-F, 3-pin, Automixing (BLUE)

1) For panel-mount, Provide Whirlwind WC3F, 3-pole female XLR connector in blue color shell.

2) No colored trim rings allowed, such as Neutrik.

d. 1/4” Tip/Ring/Sleeve

1) For panel-mount, Provide Neutrik NJ3FP6C, locking tip/ring/sleeve connector.

2) For cable-end, provide Neutrik NP3X, tip/ring/sleeve connector.

e. Phono

1) For panel-mount, Provide Neutrik NF-2D series, with appropriate color isolation washer.

2) For cable-end, provide Neutrik NF2C-B-2 “Profi” connector.

2. Production Intercom:

    a. XLR-M, 3-pin, Intercom (RED)

        1) For panel-mount, Provide Whirlwind WC3M, 3-pole male XLR connector in red color shell.

        2) No colored trim rings allowed, such as Neutrik.

3. Integrated Control Systems:

    a. For panel-mount in configurations using legacy data and power bus (AxLink or Cresnet), provide Neutrik NC4FD-L-1, 4-pole female XLR connector.

    b. For panel-mount in configurations using networked control bus, refer to RJ-45 data information below.

    c. Cable-end configurations are project dependent. See drawings.

4. Loudspeaker:

    a. For panel-mount in 2 or 4-conductor applications, use Neutrik Speakon NL4MP 4-pole connector.

    b. For panel-mount in 8-conductor applications, use Neutrik Speakon NL8MPR 8- pole connector.

    c. For cable-end in 2 or 4-conductor applications, use Neutrik Speakon NL4FC 4- pole connector.

    d. For cable-end in 8-conductor applications, use Neutrik Speakon NL8FC 8-pole connector.

5. Video:

    a. Production Video/12G:

        1) For panel-mount, Provide Neutrik NBB75DFIX, recessed bulkhead jack, feed through, isolated connector.

        2) For cable-end, provide Neutrik NBNC75B-series, push-pull style connector. Use appropriate connector for cable specified.

    b. “F” Connector:

        1) For panel-mount, provide Holland G-F81F* inline barrel connector with 3.0 GHz minimum performance.

2) For cable-end, provide Holland Superlok G-series compression connector with 3.0 GHz minimum performance.

6. RF Antenna – 50-ohm

a. For panel-mount, Provide Canare BJ-JRUD, recessed bulkhead jack, feed through, isolated connector.

b. For cable-end, provide Canare BP-C series. Use appropriate connector for cable specified.

7. Data:

a. RJ-45

1) For panel-mount, provide Neutrik Ethercon NE8 series punch-down connector in black to match cable type.

2) For cable end, provide Neutrik Ethercon NE8-series connectors in black to match cable type.

b. Fiber

1) For panel-mount, provide Neutrik Opticalcon NO2-4FD feed-thru panel mount connectors.

2) For cable end, provide Neutrik Opticalcon cables in quantities shown in 274116-A equipment list.

a) For SMPTE broadcast camera applications where Neutrik Opticalcon is indicated provide with both fiberoptic and copper terminations.

E. Patchbays:

1. Microphone and Line Level Audio (Longframe):

a. Provide Bittree 489 programmable series with 3-pin molex style termination with the following options:

1) Longframe ¼”-style connectors

2) 2x24 jacks with 12” deep chassis

3) 2 designation strips in over/under configuration

4) Mono spacing, 2 RU

5) Isolated Grounding

6) Normals per Drawings

7) Black in color

8) Paper designation strips. Provide .doc file to Owner for future use.

9) Provide Middle Atlantic “CLAW” patchcord holder, one per rack.

b. Patchbay layout shall be in standard “output at top, inputs at bottom” scheme with clear method for showing normals. Contractor shall be responsible for exact patchbay layout.

c. Labeling shall be as follows:

1) All labeling shall exactly match circuit in field.

2) Labeling shall be sequential per circuit type, beginning at 1.

2. Microphone and Line Level Audio (Bantam/TT):

a. Provide Bittree 969 programmable series with 3-pin molex style termination with the following options:

1) Bantam (TT) style connectors

2) 2x48 jacks with 12” deep chassis

3) 2 designation strips in over/under configuration

4) Mono spacing, 2 RU

5) Isolated Grounding

6) Normals per Drawings

7) Black in color

8) 6” deep rear lacing bar

9) Digital AES internal wire

10) Paper designation strips. Provide .doc file to Owner for future use.

11) Provide Middle Atlantic “CLAW” patchcord holder, one per rack.

b. Patchbay layout shall be in standard “output at top, inputs at bottom” scheme with clear method for showing normals. Contractor shall be responsible for exact patchbay layout.

c. Labeling shall be as follows:

1) All labeling shall exactly match circuit in field.

2) Labeling shall be sequential per circuit type, beginning at 1.

3. Loudspeaker:

a. Provide AVP, Inc. WK-U212E3-NL4MP series with solder termination and the following options:

1) 2x12 jacks with 12” deep chassis

2) 2 designation strips in over/under configuration

3) 2 RU

4) Black in color

5) Paper designation strips. Provide .doc file to Owner for future use.

b. Provide 2 output jacks from each amplifier channel. Configure as follows:

1) Amplifier “A”, Channel One Jacks:

a) Pins 1+/1- : Amp Channel One

b) Pins 2+/2-: Amp Channel Two

2) Amplifier “A”, Channel Two Jacks:

a) Pins 1+/1- : Amp Channel Two

b) Pins 2+/2-: No Connection

c) See Drawings for additional information.

d) Provide Middle Atlantic “CLAW” patchcord holder, one per rack.

4. 12G-SDI Production Video:

a. Provide Bittree Video MINI-WECO 12G+ series patchbay.

b. Provide the following configuration:

1) WECO-style connectors

2) 2x32 jacks with 12” deep chassis

3) 2 designation strips in over/under configuration

4) 2 RU

5) Normals per Drawings. Provide looping plugs in quantities needed.

6) Black in color

7) Paper designation strips. Provide .doc file to Owner for future use.

8) Provide Middle Atlantic “CLAW” patchcord holder, one per rack.

5. Data - Copper:

a. Provide Belden REVConnect Series Flush-Mount Modular Keystone Panel.

b. Provide with the following configuration:

1) CAT 6A Shielded

2) RJ45 jack with shielding to match 10GX cable type

3) 1x24 jacks with 6” deep removeable rear lacing bar

4) 1 designation strip in over configuration

5) 1 RU

6) Black in color

7) Paper designation strips. Provide .doc file to Owner for future use.

8) Provide Middle Atlantic “CLAW” patchcord holder, one per rack.

6. Data - Fiber

a. Provide Corning CCH Series fiber optic patching systems.

b. Provide housing, LC patchpanels, and required accessories for a complete installation.

2.5 PANELS:

A. General: The control receptacle panels shall consist of the appropriate connectors required for the system.

B. Physical:

1. Faceplates shall be 0.080” aluminum, edges eased, finished in fine texture, scratch-resistant powder coat, with fasteners countersunk.

a. Panels specified as flush mounted shall overlap back box by 1/2”. Surface mounted panels shall match back box size with no gaps or overlap.

b. Coordinate back box type, size and mounting with Division 26 - Electrical.

2. Color shall match the finished wall color of the wall onto which it will be mounted, unless otherwise noted. Submit color table for review.

3. Panels noted as custom color shall be factory powder coated a color selected by the Architect. Legends shall be laser etched.

4. Laser etched labels 1/4" high characters minimum, unless otherwise noted.

   a. Labeling shall be as indicated on the Drawings.

   b. Use Arial font.

5. Wall mounted panels shall mount into an industry standard back box, depending on size and quantity of connectors.

6. Rack mounted panels shall mount within industry standard equipment racks.

7. Panels mounted in floor boxes shall include a translucent flexible vinyl dirt guard as indicated on Drawings.

8. Provide complete hardware for mounting on gridiron/catwalk/pipe grid hangers where indicated on the Drawings.

9. Provide aluminum cable tie-off bars in matching color on all panels 8" wide and larger, as indicated on the Drawings.

   a. Keystone Electronics Corporation "Aluminum Oval Instrumentation Handles", part number 546, 5" wide x 2" deep handle. www.keyelco.com; 800-221-5510

C. Floor Pockets:

1. Provide flush, floor mounted pockets with cover and cable slot. Lid finish and lid type to be determined during submittal period from manufacturer's standard line.

2. Provide interior, flexible translucent PVC/vinyl dirt guard to cover receptacles. Labels shall remain visible.

3. Provide floor pocket backboxes and pour pans (if conditions warrant) to Division 26 - Electrical for installation.

PART 3 - EXECUTION

3.1 INSTALLATION- GENERAL:

A. Coordinate with Division 26 - Electrical for the proper installation of the conduit, backboxes, and electrical service as specified herein.

B. Coordinate scheduling and access with the General Contractor or Construction Manager and provide personnel lifts or ladders as required for access to the AV equipment.

C. Remove all packing materials from the Project Site. Insert operations and maintenance information into the Project record documents as specified above in Submittals.

D. Record Block Diagram: Post a laminated 11x17 as-built block diagram of the entire system (split into multiple sheets as necessary), and physically attached to the equipment rack in a logical location for Owner reference.

3.2 CABLE INSTALLATION:

A. Mark cables, regardless of length, with permanent, non-handwritten number or letter cable markers within 6-inches of both ends. There shall be no unmarked cables in the system. Marking codes used on cables shall correspond to codes used on Drawings and schedules.

B. As indicated on the Drawings, group cables according to signal type. Up to 6 separate conduit systems may be in place, divided as follows:

1. A: Microphone Level Audio

2. B: Line Level Audio

3. C: Video and Communication Level

4. D: Loudspeaker Level

5. E: Empty/Future expansion

6. F: Fiber Optic Level

C. Maintain separation of signal types when outside of conduit.

D. No cable shall be installed with a bend radius less than recommended by the manufacturer.

E. Cable types shall be as indicated on the Drawings. In plenum spaces, provide the plenum version of the specified cable type.

F. No cable splicing is allowed.

3.3 PROTECTION OF PROPERTY:

A. Contractor is responsible to provide protection for all equipment, tools and materials delivered to the Project Site prior to final acceptance by Owner. Any loss or damage is the responsibility of the contractor, until final acceptance by Owner.

3.4 SEQUENCING:

A. The Contractor shall not install any electronic equipment until the room where the equipment shall be located has been finally painted or otherwise finished and cleaned by the Contractor or Owner's Representative to be free of all dust and debris. Any damage to equipment resulting from failure to follow this requirement will result in the Contractor replacing the damaged equipment at their cost.

3.5 COMMISSIONING AND DEMONSTRATION:

A. Coordinate with Division 26 - Electrical.

B. Appropriately trained personnel shall review, test, program and otherwise complete the system, following completion of installation.

C. Upon completion of the installation, the Contractor shall notify the Architect that the system is available for formal checkout. Notification shall be provided in writing. Checkouts shall be scheduled in accordance with the Architect's schedule.

D. Audio System Tuning:

1. Following complete system installation, each device shall be set for correct gain-staging.

    a. This is best accomplished with an oscilloscope and a 400Hz tone generator, but other methods may be used.

    b. If the system has been set correctly, the console's VU meters will be at zero when the system is accomplishing the specified dB-SPL level. Every device in the audio signal path should clip at the same level, maximizing headroom and keeping the noise floor to a minimum.

2. System shall be tuned prior to final checkout by contractor, using a computer-based audio analysis program, such as SMAART, TEF, or SIMM. A factory-certified individual shall carry out the tuning.

E. Cable Television System Tuning:

1. Following complete installation, each device in the CATV system shall be tuned to exact an output of +5 dBmV, +/- 3 dBmV at the television output.

2. Audio input at the modulator shall be set in accordance with the gain staging requirements covered in the audio sections.

3. Video input at the modulator shall be set per manufacturer's guidelines.

F. Provide to the Architect and or their Consultant the following upon arrival:

1. Measurements of impedance of each loudspeaker prior to connecting it to an amplifier.

2. Measurements confirming the polarity of each loudspeaker, from output of console through entire system.

3. Measurements showing all Ethernet wiring complies with Category 5e or Category 6 requirements for full bandwidth operation.

4. Verification that every line has been sweep tested and conforms to standard requirements per signal level.

5. Measurements showing CATV output voltage at each TV outlet.

6. Demonstration of input and output of signal throughout the entire audio system.

G. Make available for review by the Architect and or their Consultant:

1. All components for physical inspection and inventory.

2. A computer to access any DSP units.

3. All installed devices in full operation, with no temporary equipment in place.

4. All portable devices, fully complete, and available to test at all plug-in locations.

5. Test equipment, including:

a. High quality media for every presentation source

b. HDMI & HD-SDI test generators

c. Portable TV with CATV receiver input

d. AC voltmeter

e. Sound level meter

f. Portable amplified loudspeaker

g. Audio analysis equipment (provides real time display, pink noise source, test oscillator, level and THD+N measurements)

h. Cablesets, adapters, and connectors for inserting the test equipment into and out of the system’s user interfaces and connector plates.

H. The Contractor shall be liable for any return visits by the Architect and/or their consultant as a result of incomplete or incorrect installation, or erroneous representation that the Systems are complete and ready for the Architect to carry out its work.

I. The Contractor shall arrange for access as necessary for inspection of equipment by the Architect and or their consultant

J. Upon completion of the commissioning, Contractor shall demonstrate operation and maintenance of the system to the Owner. Coordinate with the Owner's schedules two weeks in advance minimum.

3.6 TRAINING:

A. Provide training as follows:

1. Two days during commissioning period for maintenance staff.

2. Two days with user group one week prior to initial handover to users.

3. One day with user group and maintenance staff one month after initial training.

4. One day with user group and maintenance staff one year after initial training, but prior to warranty expiration.

B. Training shall include, but not be limited to:

1. Safety precautions.

2. Identification of all elements provided under this section.

3. Maintenance, diagnostics and trouble shooting.

4. Operation of system, including necessary software training.

5. Operations and maintenance manual orientation.

3.7 PROJECT CLOSEOUT:

A. See submittal section above for required closeout documents.

3.8 APPENDIX:

A. 27 41 16-A Equipment List

SRHS Commons
AV Systems Equipment List - 27 4116A

Notes: 1. Conduit, backboxes and electrical power required for A/V systems are provided under division 26 work.
2. This list contains key components, but does not list every piece needed for a complete system.
Contractor is responsible to provide a complete and working sytem, regardless of the completeness of this list.
3. A/R= As Required.
4. OFCI= Owner Furnish, Contractor Install

REF	DESCRIPTION	MFR	MODEL	QTY	NOTES
	COMMONS				
	Audio System- Fixed				
1PM	Audio DSP matrix / automixer, 8x8 Dante, USB	QSC	Core 8 Flex	1	
2PM	Audio DSP Scripting engine license	QSC	SL-QSE-110-P	1	
3PM	Audio DSP UCI Software License	QSC	SL-QUD-110-P	1	
4PM	Audio over IP Switch, Gigabit, Q-SYS/Dante	Cisco	A/R	1	
5PM	*Wireless Mics*				
6PM	Wireless Mic Handheld TX & RX	Sennheiser	EW-D 835 set	2	
7PM	Rechargeable Battery	Sennheiser	BA 70	2	
8PM	2-port battery charger, drop in	Sennheiser	EW-D Charging Set	1	
9PM	Antenna Distribution	Sennheiser	ASA 1	1	Pair
10PM	*Loudspeaker System*				
11PM	Playback Speakers (L/R), white, passive	QSC	AD-S162T	2	
12PM	Amplifier, 2-ch, 300w/ch @ 8ohms	Lea	Connect 352	1	
13PM					
14PM					
15PM	Miscellaneous Hardware				
16PM	Wire & Cable				
17PM	Labor				
	Assistive Listening				
1AL	FM Transmitter	Listen Tech.	LT-800-072	1	Use owner furnished receivers
2AL	FM Transmitter Rackmount	Listen Tech.	LA-326	1	
3AL	FM Transmitter Antenna	Listen Tech.	LA-123	1	
4AL					
5AL					
6AL	Miscellaneous Hardware				
7AL	Wire & Cable				
8AL	Labor				

REF	DESCRIPTION	MFR	MODEL	QTY	NOTES
	Video Systems- Display				
1VI	163" DV-LED (1.8mm), ERO, 1920x1080 Kit	Planar	6Wx6H TVF1.8mm-ERO LED Wall	1	Z6 controller, PSU, mount, frame, spares
	<Reference Planar Quote #00107098>				
2VI	Manufacturer Supplied 3-Year Maintenance	Planar	<incl>		
3VI	Manufacturer Supplied Installation / setup	Planar	<incl>		
4VI	*Video Systems- Transport / Switching*				
5VI	HDMI Encode/Decode, 3x2	QSC	NV-32-H	1	
6VI	HDMI Encode/Decode, rack mount	QSC	NV-RMK	1	
7VI	HDMI Transmitter, Decora	Crestron	HD-TX-4KZ-101-1G-W	1	Room Panel
8VI	HDMI Reciever, Brick	Crestron	HD-RX-4KZ-101	1	Rack
9VI	BYOD Player	WolfVision	Cynap Pure	1	or equal
10VI	Custom I/O Rack Panel, HDMI	Contractor	A/R	1	
11VI					
12VI					
13VI	Miscellaneous Hardware				
14VI	Wire & Cable				
15VI	Labor				
16VI					
17VI					
18VI					
19VI	***Control System***				
20VI	Touchpanel, Wired, 7", Panel Mount	QSC	TSC-70-G3	1	Commons
21VI	Locking Panel	FSR	OWB-CP1	1	Recessed in Wall
22VI	Control System Programming	Custom	Custom	1	Use certified programmer
23VI					
24VI					
25VI	Miscellaneous Hardware				
26VI	Wire & Cable				
27VI	Labor				
	Utility				
1PP	Power sequencer / Conditioner	Surge-X	SEQ-1U	1	
2PP	Equipment Rack, Wall Mount	Middle Atlantic	DWR Series	1	See specs for accessories, Room 131 (left wall)

REF	DESCRIPTION	MFR	MODEL	QTY	NOTES
3PP	*Plates & Panels*				
4PP	Gang Panel	Contractor	Contractor	A/R	
5PP	Multi-I/O Panel	Contractor	Contractor	A/R	
6PP					
7PP					
8PP	Miscellaneous Hardware				
9PP	Wire & Cable				
10PP	Labor				
		END OF SECTION			

SECTION 28 31 00

NETWORKED FIRE ALARM SYSTEM

PART 1 – GENERAL

1.1 RELATED SECTIONS

A. Section 26 05 19 Conductors and Cables

1.2 DESCRIPTION

A. The fire alarm system shall comply with requirements of NFPA Standard 72 for Protected Premises Signaling Systems except as modified and supplemented by this specification. The system shall be electrically supervised and monitor the integrity of all conductors.

B. Furnish and install Fire Alarm System including all wiring and connections and other materials as shown on Plans and specified herein. It is the intent that a complete operating system conforming to all applicable codes be installed and that any power supplies, relays, resistors, cards, modules, programming, or other items required to achieve this end result shall be furnished whether or not such item or items are specified herein.

C. The wiring shall be per system manufacturer's requirements. The cable shall be approved for fire alarm systems, UL rated, and run in conduit. Provide sleeves through walls and floor and seal with fire-stop material.

D. The facility shall have an emergency voice alarm communication system. Digitally stored message sequences shall notify the building occupants that a fire or life safety condition has been reported. Message generator(s) shall be capable of automatically distributing up to eight (8) simultaneous, unique messages to appropriate audio zones within the facility based on the type and location of the initiating event. The Fire Command Center (FCC) shall also support Emergency manual voice announcement capability for both system wide or selected audio zones, and shall include provisions for the system operator to override automatic messages system wide or in selected zones.

E. The system shall be able to support additional, alternate Fire Command Centers, which shall be capable of simultaneous monitoring of all system events. Alternate Fire Command Centers shall also support an approved method of transferring the control functions to an alternate Fire Command Center when necessary. All Fire Command Centers shall be individually capable of assuming Audio Command functions such as Emergency Paging,

audio zone control functions, and Firefighter's Telephone communication functions.

F. Each designated zone shall transmit separate and different alarm, supervisory and trouble signals to the Fire Command Center (FCC) and designated personnel in other buildings at the site via a multiplex communication network.

G. The FACP and peripheral devices shall be manufactured 100% by a single U.S. manufacturer (or division thereof). It's acceptable for peripheral devices to be manufactured outside of the U.S. by a division of the U.S. based parent company.

H. The system and its components shall be Underwriters Laboratories, Inc. listed under the appropriate UL testing standard as listed herein for fire alarm applications and the installation shall be in compliance with the UL listing.

I. The installing company shall employ NICET (minimum Level II Fire Alarm Technology) technicians on site to guide the final checkout and to ensure the systems integrity.

1.3 SCOPE:

A. A new control relay shall be installed and connected to system for Audio Visual system speaker silencing.

B. Basic Performance:

1. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded on Class B Signaling Line Circuits (SLC).
2. Device Circuits (IDC) shall be wired Class B as part of an addressable device connected by the SLC Circuit.
3. Notification Appliance Circuits (NAC) shall be wired Class B as part of an addressable device connected by the SLC Circuit.
4. A single ground fault or open circuit on the system Signaling Line Circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.
5. Alarm signals arriving at the FACP shall not be lost following a primary power failure (or outage) until the alarm signal is processed and recorded.
6. Speaker circuits may be controlled by NAC outputs built into the amplifiers, which shall function as addressable points on the Digital Audio Loop.
7. NAC speaker circuits shall be arranged such that there is a minimum of one speaker circuit per floor of the building or smoke zone which ever is greater.
8. Audio amplifiers and tone generating equipment shall be electrically supervised for normal and abnormal conditions.

9. NAC speaker circuits and control equipment shall be arranged such that loss of any one (1) speaker circuit will not cause the loss of any other speaker circuit in the system.
10. Two-way emergency telephone communication circuits shall be supervised for open and short circuit conditions.
11. Speaker circuits shall be arranged such that there is a minimum of one speaker circuit per smoke zone.
12. Speaker circuits shall be electrically supervised for open and short circuit conditions. If a short circuit exists on a speaker circuit, it shall not be possible to activate that circuit.
13. Audio amplifiers and tone generating equipment shall be electrically supervised for abnormal conditions. Digital amplifiers shall provide built-in speaker circuits, field configurable as four Class B (Style Y) circuits.
14. Digital amplifiers shall be capable of storing up to two minutes of digitally recorded audio messages and tones. The digital amplifiers shall also be capable of supervising the connection to the associated digital message generator, and upon loss of that connection shall be capable of one of the following system responses:

    a. The digital amplifier shall automatically broadcast the stored audio message.
    b. The digital amplifier shall switch to a mode where a local bus input on the digital amplifier will accept an input to initiate a broadcast of the stored message. This bus input shall be connected to a NAC on a local FACP for the purpose of providing an alternate means of initiating an emergency message during a communication fault condition.
    c. Speaker circuits shall be either 25 VRMS or 70VRMS. Speaker circuits shall have 20% space capacity for future expansion or increased power output requirements.
    d. Two-way emergency telephone (Fire Fighter Telephone) communication shall be supported between the Audio Command Center and up to seven (7) remote Fire Fighter's Telephone locations simultaneously on a telephone riser.
    e. Means shall be provided to connect FFT voice communications to the speaker circuits in order to allow voice paging over the speaker circuit from a telephone handset.
    f. The digital audio message generator shall be of reliable, non-moving parts, and support the digital storage of up to 32 minutes of tones and emergency messages, shall support programming options to string audio segments together to create up to 1000 messages, or to loop messages and parts of messages to repeat for pre-determined cycles or indefinitely.

1.4 GUARANTEE:

A. The fire alarm control panel, voice panels and any head-end equipment shall have a manufacturer's warranty of a minimum of 3 years.

1.5 SUBMITTALS

A.

Submittals: Furnish catalog data, shop drawings, one-line diagrams, and scaled plan drawings. Building plans shall be *1/8"=1'0",* and site plans shall be no smaller than 1"=40'. Minimum text height shall be 3/32" high. Contractor shall also submit name of firm he proposes to do work under this Section, addresses, phone numbers, and name of firm's contact, for approval. Such firms shall be factory authorized representatives of the equipment specified, who shall furnish all equipment, make all connections to same, and place the systems in operation. Such firms shall have offices and service departments within a 100 mile radius of project and shall have been in business of this type for at least five years.

Copies of WKM design drawings are not acceptable for submittal drawings. Two submittal reviews will be made by the Architect's representative. Subsequent reviews will be charged to the Contractor. A rejection of a submittal or review of a partially presented submittal constitutes one submittal review.

1. Fire alarm system design and products have been reviewed and approved by DSA. Alterations to design and/or substitutions proposed by the contractor shall require the following to be included with the fire alarm submittal:

a. Riser diagram.

b. Point-to-point diagram.

c. Mounting detail showing elevations of wall mounted devices.

d. List of system components, equipment, and devices, including manufacturer's model number(s) and California State Fire Marshal listing numbers.

e. Copies of manufacturer's specification sheets for equipment and devices indicated.

f. Voltage drop calculations — include the following information for the worst case:

1) Point-to-Point or ohms law calculations.

2) Zone used in calculations.

3) Voltage drop percent (not to exceed manufacturer's requirement(s). Note: If voltage drop exceeds 10%, indicate manufacturer's listed operating voltage ranges(s) for equipment and devices.

g. Battery type(s), amp hours, and load calculations – include the

following information:

1) Normal Operation: 100% of applicable devices for 24 hours = control panel amps plus list of amps per device which draw power from the panel during standby power condition – i.e.:

a) Zone modules.
b) Detectors.
c) Other devices (identify).

(Note: These specifications require standby power for 72 hours. The specified duration shall be used in calcs.)

2) Alarm Condition: 100% of applicable devices for 5 minutes = control panel amps plus list of amps per device which draw power from the panel during alarm condition — i.e.:

a) Zone modules.
b) Signal modules.
c) Detectors.
d) Signal devices
e) Annunciator.
f) Other devices (identify).

3) Normal Operation + Alarm Condition:

a) Total amp hours required.

B. b)Total amp hours provided.

1.5 POST CONTRACT MAINTENANCE:

A. Complete maintenance and repair service for the fire detection system shall be available from a factory trained authorized representative of the manufacturer of the major equipment for a period of five (5) years after expiration of the guaranty.

B. As part of the bid/proposal, include a quote for a maintenance contract to provide all maintenance, required tests, and list pricing for any replacement products included on the bill of materials, along with the list pricing for products not on the bill of materials; if test and inspection rates are different than full service rates the bid/proposal shall include pricing for all levels for a minimum period of five (5) years Rates and costs shall be valid for the period of five (5) years after expiration of the guaranty.

C. Include also a quote for unscheduled maintenance/repairs, including hourly rates for technicians trained on this equipment, and response travel costs for each year of the maintenance period. Submittals that do not identify all post contract maintenance costs will not be accepted. Rates and costs shall be valid for the period of five (5) years after expiration of the guaranty.

D. As part of the submittal, include a quotation for all parts and material, and all installation and test labor as needed to increase the number of intelligent or addressable devices by ten percent (10%). This quotation shall include intelligent smoke detectors, intelligent heat detectors, addressable manual stations, addressable monitor modules and addressable modules equal in number to one tenth of the number required to meet this specification (list actual quantity of each type).

E. The quotation shall include installation, test labor, and labor to reprogram the system for this 10% expansion. If additional FACP hardware is required, include the material and labor necessary to install this hardware.

F. Do not include cost of conduit or wire or the cost to install conduit or wire except for labor to make final connections at the FACP and at each intelligent addressable device. Do not include the cost of conventional peripherals or the cost of initiating devices or notification appliances connected to the addressable monitor/control modules.

G. Submittals that do not include this estimate of post contract expansion cost will not be accepted.

1.6 APPLICABLE STANDARDS AND SPECIFICATIONS:

A. The specifications and standards listed below form a part of this specification. The system shall fully comply with the latest issue of these standards, if applicable.

B. National Fire Protection Association (NFPA) - USA:

No. 12	Extinguishing Systems (low and high)
No. 12A	Halon 1301 Extinguishing Systems
No. 13	Sprinkler Systems
No. 15	Water Spray Systems
No. 16	Foam / Water Deluge and Spray Systems
No. 17	Dry Chemical Extinguishing Systems
No. 17A	Wet Chemical Extinguishing Systems
No. 2001	Clean Agent Extinguishing Systems
No. 70	National Electric Code
No. 90A	Air Conditioning Systems

No. 92A	Smoke Control Systems
No. 92B	Smoke Management Systems in Malls, Atria, Large Areas
No. 72	National Fire Alarm Code

C. Underwriters Laboratories Inc. (UL) - USA:

No. 268	Smoke Detectors for Fire Protective Signaling Systems
No. 864	Control Units for Fire Protective Signaling Systems
No. 2572	Mass Notification Systems
No. 217	Smoke Detectors, Single and Multiple Station
No. 228	Door Closers - Holders for Fire Protective Signaling Systems
No. 268A	Smoke Detectors for Duct Applications
No. 521	Heat Detectors for Fire Protective Signaling Systems
No. 464	Audible Signaling Appliances
No. 38	Manually Actuated Signaling Boxes
No. 1481	Power Supplies for Fire Protective Signaling Systems
No. 346	Waterflow Indicators for Fire Protective Signaling Systems
No. 1076	Control Units for Burglar Alarm Proprietary Protective Signaling Systems
No. 1971	Visual Notification Appliances
No. 2017	Standard for General-Purpose Signaling Devices and Systems
No.60950	Safety of Information Technology Equipment

D. Local and State Building Codes.

E. All requirements of the Authority Having Jurisdiction (AHJ).

1.7 APPROVALS:

A. The system shall have proper listing and/or approval from the following nationally recognized agencies:

UL	Underwriters Laboratories, Inc
FM	Factory Mutual
CSFM	California State Fire Marshal

B. The system shall be certified for seismic applications in accordance with the California Building Code (CBC). The basis for qualification of seismic approval shall be via shake table testing.

PART 2 - PRODUCTS

2.1 MAIN FIRE ALARM CONTROL PANEL OR NETWORK NODE:

A. Main FACP is a Notifier NFS2-3030.

B. In conjunction with intelligent Loop Control Modules and Loop Expander Modules, the main FACP shall perform the following functions:

1. Supervise and monitor all intelligent addressable detectors and monitor modules connected to the system for normal, trouble and alarm conditions.
2. Supervise all initiating signaling and notification circuits throughout the facility by way of connection to addressable monitor and control modules.
3. Detect the activation of any initiating device and the location of the alarm condition. Operate all notification appliances and auxiliary devices as programmed. In the event of CPU failure, all SLC loop modules shall fallback to degrade mode. Such degrade mode shall treat the corresponding SLC loop control modules and associated detection devices as conventional two-wire operation. Any activation of a detector in this mode shall automatically activate associated Notification Appliance Circuits.

2.2 System Capacity and General Operation

A. The FACP shall be capable of communicating over a Local Area Network (LAN) or Wide Area Network (WAN) utilizing a peer-to-peer, inherently regenerative communication format and protocol. The network shall support communication speed up to 100 Mb and support up to 200 panels / nodes per network.

B. The control panel shall be capable of expansion via up to 10 SLC loops. Each module shall support up to 318 analog/addressable devices for a maximum system capacity of 3180 points. The Fire Alarm Control Panel shall include a full featured operator interface control and annunciation panel that shall include a backlit 640-character liquid crystal display, individual, color coded system status LEDs, and a keypad for the control of the fire alarm system. Said LCD shall also support graphic bit maps capable of displaying the company name and logo of either company.

C. All programming or editing of the existing program in the system shall be achieved without interrupting the alarm monitoring functions of the fire alarm control panel.

D. The FACP shall be able to provide the following software and hardware features:

1. Pre-signal and Positive Alarm Sequence: The system shall provide means to cause alarm signals to only sound in specific areas with a delay of the

alarm from 60 to up to 180 seconds after start of alarm processing. In addition, a Positive Alarm Sequence selection shall be available that allows a 15-second time period for acknowledging an alarm signal from a fire detection/initiating device. If the alarm is not acknowledged within 15 seconds, all local and remote outputs shall automatically activate immediately.

2. Smoke Detector Pre-alarm Indication at Control Panel: To obtain early warning of incipient or potential fire conditions, the system shall support a programmable option to determine system response to real-time detector sensing values above the programmed setting. Two levels of Pre-alarm indication shall be available at the control panel: alert and action.
3. Alert: It shall be possible to set individual smoke detectors for pre-programmed pre-alarm thresholds. If the individual threshold is reached, the pre-alarm condition shall be activated.
4. Action: If programmed for Action and the detector reaches a level exceeding the pre-programmed level, the control panel shall indicate an action condition. Sounder bases installed with either heat or smoke detectors shall automatically activate on action Pre-Alarm level, with general evacuation on Alarm level.
5. The system shall support a detector response time to meet world annunciation requirements of less than 3 seconds.
6. Device Blink Control: Means shall be provided to turn off detector/module LED strobes for special areas.
7. NFPA 72 Smoke Detector Sensitivity Test: The system shall provide an automatic smoke detector test function that meets the sensitivity testing requirements of NFPA 72.
8. Programmable Trouble Reminder: The system shall provide means to automatically initiate a reminder that troubles exist in the system. The reminder will appear on the system display and (if enabled) will sound a piezo alarm.
9. On-line or Off-line programming: The system shall provide means to allow panel programming either through an off-line software utility program away from the panel or while connected and on-line. The system shall also support upload and download of programmed database and panel executive system program to a Personal Computer/laptop. A single change to one CPU database shall not require a database download to other CPUs.
10. History Events: The panel shall maintain a history file of the last 4000 events, each with a time and date stamp. History events shall include all alarms, troubles, operator actions, and programming entries. The control panels shall also maintain a 1000 event Alarm History buffer, which consists of the 1000 most recent alarm events from the 4000 event history file.

11. Smoke Control Modes: The system shall provide means to perform FSCS mode Smoke Control to meet NFPA-92A and 90B and HVAC mode to meet NFPA 90A.
12. The system shall provide means for all SLC devices on any SLC loop to be auto programmed into the system by specific address. The system shall recognize specific device type ID's and associate that ID with the corresponding address of the device.
13. Passwords and Users: The system shall support two password levels, master and user. Up to 9 user passwords shall be available, each of which may be assigned access to the programming change menus, the alter status menus, or both. Only the master password shall allow access to password change screens.
14. Block Acknowledge: The system shall support a block Acknowledge for Trouble Conditions
15. Sensitivity Adjust: The system shall provide Automatic Detector Sensitivity Adjust based on Occupancy schedules including a Holiday list of up to 15 days.
16. Environmental Drift Control: The system shall provide means for setting Environmental Drift Compensation by device. When a detector accumulates dust in the chamber and reaches an unacceptable level but yet still below the allowed limit, the control panel shall indicate a maintenance alert warning. When the detector accumulates dust in the chamber above the allowed limit, the control panel shall indicate a maintenance urgent warning.
17. Custom Action Messages: The system shall provide means to enter up to 100 custom action messages of up to 160 characters each. It shall be possible to assign any of the 100 messages to any point.
18. Local Mode: If communication is lost to the central processor the system shall provide added survivability through the intelligent loop control modules. Inputs from devices connected to the SLC and loop control modules shall activate outputs on the same loop when the inputs and outputs have been set with point programming to participate in local mode or when the type codes are of the same type: that is, an input with a fire alarm type code shall activate an output with a fire alarm type code.
19. Read status preview - enabled and disabled points: Prior to re-enabling points, the system shall inform the user that a disabled device is in the alarm state. This shall provide notice that the device must be reset before the device is enabled thereby avoiding activation of the notification circuits.
20. Custom Graphics: When fitted with an LCD display, the panel shall permit uploading of a custom bit-mapped graphic to the display screen.
21. Multi-Detector and Cooperating Detectors: The system shall provide means to link one detector with up to two detectors at other addresses on the same loop in cooperative multi-detector sensing. There shall be no requirement for sequential addresses on the detectors and the alarm event shall be a result ofall cooperating detectors chamber readings.

22. ACTIVE EVENT: The system shall provide a Type ID called FIRE CONTROL for purposes of air-handling shutdown, which shall be intended to override normal operating automatic functions. Activation of a FIRE CONTROL point shall cause the control panel to (1) initiate the monitor module Control-by-Event, (2) send a message to the panel display, history buffer, installed printer and annunciators, (3) shall not light an indicator at the control panel, (4) Shall display ACTIVE on the LCD as well a display a FIRE CONTROL Type Code and other information specific to the device.
23. NON-FIRE Alarm Module Reporting: A point with a type ID of NON-FIRE shall be available for use for energy management or other non-fire situations. NON-FIRE point operation shall not affect control panel operation nor shall it display a message at the panel LDC. Activation of a NON-FIRE point shall activate control by event logic but shall not cause any indication on the control panel.
24. Mass Notification Override:The system shall be UL 2572 listed for Mass Notification and shall be capable, based on the Risk Analysis, of being programmed so that Mass Notification/Emergency Communications events take precedence over fire alarm events.
25. Security Monitor Points: The system shall provide means to monitor any point as a type security.
26. One-Man Walk Test: The system shall provide both a basic and advanced walk test for testing the entire fire alarm system. The basic walk test shall allow a single operator to run audible tests on the panel. All logic equation automation shall be suspended during the test and while annunciators can be enabled for the test, all shall default to the disabled state. During an advanced walk test, field-supplied output point programming will react to input stimuli such as CBE and logic equations. When points are activated in advanced test mode, each initiating event shall latch the input. The advanced test shall be audible and shall be used for pull station verification, magnet activated tests on input devices, input and output device and wiring operation/verification.
27. Control By Event Functions: CBE software functions shall provide means to program a variety of output responses based on various initiating events. The control panel shall operate CBE through lists of zones. A zone shall become listed when it is added to a point's zone map through point programming. Each input point such as detector, monitor module or panel circuit module shall support listing of up to 10 zones into its programmed zone map.
28. Permitted zone types shall be general zone, releasing zone and special zone. Each output point (control module, panel circuit module) can support a list of up to 10 zones including general zone, logic zone, releasing zone and trouble zone. It shall be possible for output points to be assigned to list general alarm. Non-Alarm or Supervisory points shall not activate the general alarm zone.

29. 1000 General Zones: The system shall support up to 1000 general purpose software zones for linking inputs to outputs. When an input device activates, any general zone programmed into that device's zone map will be active and any output device that has an active general zone in its map will be active. It shall also be possible to use general zone as arguments in logic equations.
30. 1000 Logic Equations: The system shall support up to 1000 logic equations for AND, OR, NOT, ONLY1, ANYX, XZONE or RANGE operators that allow conditional I/O linking. When any logic equation becomes true, all output points mapped to the logic zone shall activate.
31. 100 trouble equations per device: The system shall provide support for up to 100 trouble equations for each device, which shall permit programming parameters to be altered, based on specific fault conditions. If the trouble equation becomes true, all output points mapped to the trouble zone shall activate.
32. Control-By-Time: A time based logic function shall be available to delay an action for a specific period of time based upon a logic input with tracking feature. A latched version shall also be available. Another version of this shall permit activation on specific days of the week or year with ability to set and restore based on a 24 hour time schedule on any day of the week or year.
33. Multiple agent releasing zones: The system shall support up to 10 releasing zones to protect against 10 independent hazards. Releasing zones shall provide up to three cross-zone and four abort options to satisfy any local jurisdiction requirements.
34. Alarm Verification, by device, with timer and tally: The system shall provide a user-defined global software timer function that can be set for a specific detector. The timer function shall delay an alarm signal for a user-specified time period and the control panel shall ignore the alarm verification timer if another alarm is detected during the verification period. It shall also be possible to set a maximum verification count between 0 and 20 with the "0" setting producing no alarm verification. When the counter exceeds the threshold value entered, a trouble shall be generated to the panel.
35. Secure/Access Operation: The system shall have the capability of configuring input modules to monitor status of door contact or other security type sensors. These input modules shall be able to be commanded from the normally ‘Secure’ state to an ‘Access’ state. While in the secure state, the module will transmit alarm conditions to the controller, which shall be annunciated on the LCD and LED displays. The modules shall be placed into the Access state either through the LCD display or through predefined operator keys. While in the Access state, all alarms from the module will be shunted. Placing the module into the access state shall cause a discrete LED associated with input point to flash, but no other trouble or disable condition will be annunciated. Change from Secure

to Access and reverse shall be transmitted to the central monitoring station on a per zone basis. Systems that cause or indicate a trouble or disable condition are unacceptable.

E. Network Communication

1. The FACP shall be capable of communicating on Noti-Fire-Net over a Local Area Network (LAN) or Wide Area Network (WAN) utilizing a peer-to-peer, inherently regenerative communication format and protocol. The network shall support communication speed up to 100 Mb and support up to 200 panels/nodes per network.

F. Central Processing Unit

1. The Central Processing Unit shall contain and execute all control-by-event (including Boolean functions including but not limited to AND, OR, NOT, ANYx, and CROSSZONE) programs for specific action to be taken if an alarm condition is detected by the system. Such control-by-event programs shall be held in non-volatile programmable memory, and shall not be lost with system primary and secondary power failure.
2. The Central Processing Unit shall also provide a real-time clock for time annotation, to the second, of all system events. The time-of-day and date shall not be lost if system primary and secondary power supplies fail.
3. The CPU shall be capable of being programmed on site without requiring the use of any external programming equipment. Systems that require the use of external programmers or change of EPROMs are not acceptable.
4. The CPU shall provide an EIA-232 interface between the fire alarm control panel and the UL Listed Electronic Data Processing (EDP) peripherals.
5. The CPU shall provide two EIA-485 ports for the serial connection to annunciation and control subsystem components.
6. The EIA-232 serial output circuit shall be optically isolated to assure protection from earth ground.

G. Display

1. The system display shall provide a 640-character backlit alphanumeric Liquid Crystal Display (LCD). It shall also provide eleven Light-Emitting-Diodes (LEDs) that indicate the status of the following system parameters: AC POWER, FIRE ALARM, PREALARM, SECURITY, SUPERVISORY, SYSTEM TROUBLE, OTHER EVENT, SIGNALS SILENCED, POINT DISABLED, CONTROLS ACTIVE, and CPU FAILURE.
2. The system display shall provide a keypad with control capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels with up to ten (one Master and nine User) passwords shall be accessible through

the display interface assembly to prevent unauthorized system control or programming.

H. Loop (Signaling Line Circuit) Control Module:
   1. The Loop Control Module shall monitor and control a minimum of 318 intelligent addressable devices. This includes 159 intelligent detectors (Ionization, Photoelectric, or Thermal) and 159monitor or control modules.
   2. The Loop Control Module shall contain its own microprocessor and shall be capable of operating in a local/degrade mode (any addressable device input shall be capable of activating any or all addressable device outputs) in the unlikely event of a failure in the main CPU.
   3. Each Loop shall be capable of operating as a NFPA Style 4 (Class B) circuit. Fault isolation modules shall be installed between each addressable SLC device per the manufacturers installation instructions. Systems which cannot provide full loop loading in Style 7 configurations are not acceptable.
   4. The SLC interface board shall receive analog or digital information from all intelligent detectors and shall process this information to determine whether normal, alarm, or trouble conditions exist for that particular device. Each SLC Loop shall be isolated and equipped to annunciate an Earth Fault condition. The SLC interface board software shall include software to automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information may also be used for automatic detector testing and the automatic determination of detector maintenance requirements.

I. Digital Voice Command Center

   1. The Digital Voice Command Center located with the FACP, shall contain all equipment required for all audio control, emergency telephone system control, signaling and supervisory functions. This shall include speaker zone indication and control, telephone circuit indication and control, digital voice units, microphone and main telephone handset.
   2. Function: The Voice Command Center equipment shall perform the following functions:

      a. Operate as a supervised multi-channel emergency voice communication system.
      b. Operate as a two-way emergency telephone system control center.
      c. Audibly and visually annunciate the active or trouble condition of every speaker circuit and emergency telephone circuit.
      d. Audibly and visually annunciate any trouble condition for digital tone and voice units required for normal operation of the system.

e. Provide all-call Emergency Paging activities through activation of a single control switch.
f. As required, provide vectored paging control to specific audio zones via dedicated control switches.
g. Provide a factory recorded "library" of voice messages and tones in standard WAV. File format, which may be edited and saved on a PC running a current Windows® operating system.
h. Provide a software utility capable of off-line programming for the DVC operation and the audio message files. This utility shall support the creation of new programs as well as editing and saving existing program files. Uploading or downloading the DVC shall not inhibit the emergency operation of other nodes on the fire alarm network.
i. Support an optional mode of operation with four analog audio outputs capable of being used with UL 864 fire-listed analog audio amplifiers and SLC controlled switching.
j. The Digital Voice Command shall be modular in construction, and shall be capable of being field programmable without requiring the return of any components to the manufacturer and without requiring use of any external computers or other programming equipment.
k. The Digital Voice Command and associated equipment shall be protected against unusually high voltage surges or line transients.

J. Power Supply:

1. The Main Power Supply shall operate on 120/240 VAC, 50/60 Hz, and shall provide all necessary power for the FACP.
2. The Main Power Supply shall provide the required power to the CPU using a switching 24 VDC regulator and shall incorporate a battery charger for 24 hours of standby power using dual-rate charging techniques for fast battery recharge.
3. The Main Power Supply shall provide a battery charger for 24 hours of standby using dual-rate charging techniques for fast battery recharge. The supply shall be capable of charging batteries ranging in capacity from 7-200 amp-hours within a 48-hour period.
4. The Main Power Supply shall provide a very low frequency sweep earth detect circuit, capable of detecting earth faults.
5. The Main Power Supply shall be power-limited per UL864 requirements.
6. The Main Power Supply shall communicate power supply, line voltage, battery status and charger status to the local LCD display. Any abnormal condition shall be annunicated and logged to the system alarm history log.
7. Addressable Charger Power SupplyThe auxiliary addressable power supply is a remote 24 VDC power supply used to power Notification Devices and field devices that require regulated 24 VDC power.
8. The addressable power supply for the fire detection system shall provide up to a minimum of 6.0 amps of 24 volt DC regulated power for Notification

Appliance Circuit (NAC) power or 10.0 amps of 24 volt DC general power. The power supply shall have an additional 0.5 amp of 24 VDC auxiliary power for use within the same cabinet as the power supply. It shall include an integral charger designed to charge 12 - 200 amp hour batteries.

9. The addressable power supply shall provide four individually addressable Notification Appliance Circuits that may be configured as Class "B" circuits. All circuits shall be power-limited per UL 864 requirements.
10. The addressable power supply shall provide built-in synchronization for certain Notification Appliances on each circuit without the need for additional synchronization modules. The power supply's output circuits shall be individually selected for synchronization. A single addressable power supply shall be capable of supporting both synchronized and non-synchronized Notification Devices at the same time.
11. The addressable power supply shall operate on 120 or 240 VAC, 50/60 Hz.
12. The interface to the power supply from the Fire Alarm Control Panel (FACP) shall be via the Signaling Line Circuit (SLC) or other multiplexed means Power supplies that do not use an intelligent interface are not suitable substitutes. The required wiring from the FACP to the addressable power supply shall be a single unshielded twisted pair wire.
13. The addressable power supply shall supervise for battery charging failure, AC power loss, power brownout, battery failure, NAC loss, and optional ground fault detection. In the event of a trouble condition, the addressable power supply shall report the incident and the applicable address to the FACP via the SLC.
14. The addressable power supply shall have an AC Power Loss Delay option. If this option is utilized and the addressable power supply experiences an AC power loss, reporting of the incident to the FACP will be delayed. A delay time of zero, two, eight or sixteen hours shall be programmable.
15. The addressable power supply shall have an option for Canadian Trouble Reporting and this option shall be programmable.
16. The addressable power supply mounts in either the FACP backbox or it's own dedicated surface mounted backbox with cover.
17. Each of the power supply's four output circuits shall be programmed- for Notification Appliance Circuit or General Purpose 24 VDC power. Any output circuit shall be able to provide up to 2.5 amps of 24 VDC power.
18. The addressable power supply's output circuits shall be individually supervised when they are selected to be either a Notification Appliance Circuit when wired Class "B" or by the use of and end-of-line resistor. When the power supply's output circuit is selected as General 24 VDC power, the circuit shall be individually supervised when an end-of-line relay is used.
19. When selected for Notification Appliance Circuits, the output circuits shall be individually programmable for Temporal.

20. When selected as a Notification Appliance Circuit, the output circuits of the addressable power supply shall have the option to be coded by the use of a universal zone coder.
21. The addressable power supply shall interface and synchronize with other power supplies of the same type. The required wiring to interface multiple addressable power supplies shall be a single unshielded, twisted pair wire.
22. An individual or multiple interfaced addressable power supplies shall have the option to use an external charger for battery charging. Interfaced power supplies shall have the option to share backup battery power.

K. Audio Amplifiers

1. The Audio Amplifiers will provide Audio Power () for distribution to speaker circuits.
2. Multiple audio amplifiers may be mounted in a single enclosure, either to supply incremental audio power, or to function as an automatically switched backup amplifier(s).
3. The audio amplifier shall include an integral power supply, and shall provide built-in LED indicators for the following conditions:

    a. Earth Fault on DAP A (Digital Audio Port A)
    b. Earth Fault on DAP B (Digital Audio Port B)
    c. Audio Amplifier Failure Detected Trouble
    d. Active Alarm Bus input
    e. Audio Detected on Aux Input A
    f. Audio Detected on Aux Input B
    g. Audio Detected on Firefighter's Telephone Riser
    h. Receiving Audio from digital audio riser
    i. Short circuit on speaker circuit 1
    j. Short circuit on speaker circuit 2
    k. Short circuit on speaker circuit 3
    l. Short circuit on speaker circuit 4
    m. Data Transmitted on DAP A
    n. Data Received on DAP A
    o. Data Transmitted on DAP B
    p. Data Received on DAP B
    q. Board failure
    r. Active fiber optic media connection on port A (fiber optic media applications)
    s. Active fiber optic media connection on port B (fiber optic media applications)
    t. Power supply Earth Fault
    u. Power supply 5V present
    v. Power supply conditions - Brownout, High Battery, Low Battery, Charger Trouble

4. The audio amplifier shall provide the following built-in controls:

    a. Amplifier Address Selection Switches
    b. Signal Silence of communication loss annunciation Reset
    c. Level adjustment for background music
    d. Enable/Disable for Earth Fault detection on DAP A
    e. Enable/Disable for Earth Fault detection on DAP A
    f. Switch for 2-wire/4-wire FFT riser

5. Adjustment of the correct audio level for the amplifier shall not require any special tools or test equipment.
6. Includes audio input and amplified output supervision, back up input, and automatic switch over function, (if primary amplifier should fail).
7. System shall be capable of backing up digital amplifiers.
8. One-to-one backup shall be provided by either a plug-in amplifier card or a designated backup amplifier of identical model as the primary amplifier.
9. One designated backup amplifier shall be capable of backing up multiple primary amplifiers mounted in the same or adjacent cabinets.
10. Multi-channel operation from a single amplifier shall be supported by the addition of an optional plug-in amplifier card.

L. Audio Message Generator (Prerecorded Voice)/Speaker Control:

1. Each initiating zone or intelligent device shall interface with an emergency voice communication system capable of transmitting a prerecorded voice message to all speakers in the building.
2. Actuation of any alarm initiating device shall cause a prerecorded message to sound over the speakers. The message shall be repeated four (4) times. Pre- and post-message tones shall be supported.
3. A built-in microphone shall be provided to allow paging through speaker circuits.
4. System paging from emergency telephone circuits shall be supported.
5. The audio message generator shall have the following indicators and controls to allow for proper operator understanding and control:

    a. Lamp Test
    b. Trouble
    c. Off-Line Trouble
    d. Microphone Trouble
    e. Phone Trouble
    f. Busy/Wait
    g. Page Inhibited
    h. Pre/Post Announcement Tone

M. Controls with associated LED Indicators:

1. Speaker Switches/Indicators

   a. The speaker circuit control switches/indicators shall include visual indication of active and trouble status for each speaker circuit in the system.
   b. The speaker circuit control panel shall include switches to manually activate or deactivate each speaker circuit in the system.

2. Emergency Two-Way Telephone Control Switches/Indicators

   a. The emergency telephone circuit control panel shall include visual indication of active and trouble status for each telephone circuit in the system.
   b. The telephone circuit control panel shall include switches to manually activate or deactivate each telephone circuit in the system.

N. Remote Transmissions:

1. Provide local energy or polarity reversal or trip circuits as required.
2. The system shall be capable of operating a polarity reversal or local energy or fire alarm transmitter for automatically transmitting fire information to the fire department.
3. Provide capability and equipment for transmission of zone alarm and trouble signals to remote operator's terminals, system printers and annunciators.
4. Transmitters shall be compatible with the systems and equipment they are connected to such as timing, operation and other required featur

O. Field Programming

1. The system shall be programmable, configurable and expandable in the field without the need for special tools, laptop computers, or other electronic interface equipment. There shall be no firmware changes required to field modify the system time, point information, equations, or annunciator programming/information.
2. All field defined programs shall be stored in non-volatile memory.Two levels of password protection shall be provided in addition to a key-lock cabinet. One level shall be used for status level changes such as point/zone disable or manual on/off commands (Building Manager). A second (higher-level) shall be used for actual change of the life safety program (installer). These passwords shall be five (5) digits at a minimum. Upon entry of an invalid password for the third time within a one minute time period an encrypted number shall be displayed. This number can be used as a reference for determining a forgotten password. .

3. The system programming shall be "backed" up via an upload/download program, and stored on compatible removable media. A system back-up disk shall be completed and given in duplicate to the building owner and/or operator upon completion of the final inspection. The program that performs this function shall be "non-proprietary", in that, it shall be possible to forward it to the building owner/operator upon his or her request.
4. The installer's field programming and hardware shall be functionally tested on a computer against known parameters/norms which are established by the FACP manufacturer. A software program shall test Input-to-Output correlations, device Type ID associations, point associations, time equations, etc. This test shall be performed on an IBM-compatible PC with a verification software package. A report shall be generated of the test results and two copies turned in to the engineer(s) on record.

P. Specific System Operations

1. Smoke Detector Sensitivity Adjust: A means shall be provided for adjusting the sensitivity of any or all addressable intelligent detectors in the system from the system keypad. Sensitivity range shall be within the allowed UL window and have a minimum of 9 levels.
2. Alarm Verification: Each of the intelligent addressable smoke detectors in the system may be independently selected and enabled to be an alarm verified detector. The alarm verification delay shall be programmable from 0 to 60 seconds and each detector shall be able to be selected for verification. The FACP shall keep a count of the number of times that each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.

Q. System Point Operations:

1. Any addressable device in the system shall have the capability to be enabled or disabled through the system keypad or video terminal.
2. System output points shall be capable of being turned on or off from the system keypad or the video terminal.
3. Point Read: The system shall be able to display the following point status diagnostic functions without the need for peripheral equipment. Each point shall be annunciated for the parameters listed:

    a. Device Status.
    b. Device Type.
    c. Custom Device Label.
    d. Software Zone Label.
    e. Device Zone Assignments.
    f. Analog Detector Sensitivity.
    g. All Program Parameters.

4. System History Recording and Reporting: The fire alarm control panel shall contain a history buffer that will be capable of storing up to 4000 system events. Each of these events will be stored, with time and date stamp, until an operator requests that the contents be either displayed or printed. The contents of the history buffer may be manually reviewed; one event at a time, and the actual number of activations may also be displayed and or printed. History events shall include all alarms, troubles, operator actions, and programming entries.
5. The history buffer shall use non-volatile memory. Systems which use volatile memory for history storage are not acceptable.
6. Automatic Detector Maintenance Alert: The fire alarm control panel shall automatically interrogate each intelligent system detector and shall analyze the detector responses over a period of time.
7. If any intelligent detector in the system responds with a reading that is below or above normal limits, then the system will enter the trouble mode, and the particular Intelligent Detector will be annunciated on the system display, and printed on the optional system printer. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.
8. The system shall include the ability (programmable) to indicate a "pre-alarm" condition. This will be used to alert maintenance personal when a detector is at 80% of its alarm threshold in a 60 second period.

W. System Maintenance Analysis and Reporting

1. The system shall automatically track NFPA 72 installation and testing requirements for all addressable devices to ensure that every device is functionally tested upon installation and then periodically as required by the Code.
2. If after twelve months any device has not been functionally tested a led shall illuminate on the CPU or Network annunciator indicating the device that needs testing.
3. The system shall automatically track device testing to ensure that a visual inspection is performed at least semi-annually.
4. If after six months a device has not been indicated as "visually inspected" a led shall illuminate on the CPU or Network annunciator indicating the device that needs testing.
5. A hand-held IR tool may be used to interact with each SLC device to indicate that a visual inspection has been performed. The IR device will explicitly identify the device by loop and address to ensure the correct visual inspection has been performed.
6. A comprehensive report shall be available from the laptop programmer which shows a predictive report of all devices that have upcoming testing requirements. These reports shall be configurable as either 30, 60 or 90 day predictive, current status, and "all database."

7. Systems that do not automatically track the individual testing requirements of the field devices will not be accepted.

2.3 SYSTEM COMPONENTS:

A. Fixed Emergency Telephone Handset

1. The telephone cabinet shall be painted red and clearly labeled emergency telephone. The cabinets shall be located where shown on drawings.
2. The handset cradle shall have a switch connection such that lifting the handset off of the cradle shall send a signal to the fire command center which shall audibly and visually indicate its on-line (off-hook) condition.
3. The two-way emergency telephone system shall support a maximum of seven (7) handsets on line (off hook) without degradation of the signal.

B. Universal Digital Alarm Communicator Transmitter (UDACT). The UDACT is an interface for communicating digital information between a fire alarm control panel and an UL-Listed central station.

1. The UDACT shall be compact in size, mounting in a standard module position of the fire alarm control cabinet. Optionally, the UDACT shall have the ability for remote mounting, up to 6,000 feet from the fire alarm control panel. The wire connections between the UDACT and the control panel shall be supervised with one pair for power and one pair for multiplexed communication of overall system status. Systems that utilize relay contact closures are not acceptable.
2. The UDACT shall include connections for dual telephone lines (with voltage detect), per UL/NFPA/FCC requirements. It shall include the ability for split reporting of panel events up to two different telephone numbers.
3. The UDACT shall be capable of transmitting events in 4+2, SIA, and Contact ID.
4. Communication shall include vital system status such as:

    a. Independent Zone (Alarm, trouble, non-alarm, supervisory)
    b. Independent Addressable Device Status
    c. AC (Mains) Power Loss
    d. Low Battery and Earth Fault
    e. System Off Normal
    f. 12 and 24 Hour Test Signal
    g. Abnormal Test Signal (per UL requirements)
    h. EIA-485 Communications Failure
    i. Phone Line Failure

5. The UDACT shall support independent zone/point reporting when used in the Contact ID format. In this format the UDACT shall support transmission of up to 3,064 points. This enables the central station to have exact details concerning the origin of the fire or response emergency.
6. The UDACT shall be capable of being programmed with the same programming utility as the host FACP, and saved, edited and uploaded and downloaded using the utility. UDACT shall be capable of being programmed online or offline. The programming utility shall also support upgrading UDACT operating firmware.
7. The UDACT shall be capable of generating Central Station reports providing detailed programming information for each point along with the central station point address.
8. An IP or IP/GSM Communicator option shall be available to interface to the UDACT and be capable of transmitting signals over the internet/intranet or Cellular (GSM) network to a compatible receiver.

C. Field Wiring Terminal Blocks

1. For ease of service all panel I/O wiring terminal blocks shall be removable, plug-in types and have sufficient capacity for #18 to #12 AWG wire. Terminal blocks that are permanently fixed are not acceptable.

D. Printer

1. The printer shall provide hard-copy printout of all changes in status of the system and shall time-stamp such printouts with the current time-of-day and date. The printer shall be standard carriage with 80-characters per line and shall use standard pin-feed paper. The printer shall be enclosed in a separate cabinet suitable for placement on a desktop or table. The printer shall communicate with the control panel using an interface complying with Electrical Industries Association standard EIA-232D. Power to the printer shall be 120 VAC @ 60 Hz.
2. The system shall have a strip printer capable of being mounted directly in the main FACP enclosure. Alarms shall be printed in easy-to-read RED, other messages, such as a trouble, shall be printed in BLACK. This printer shall receive power from the system power supply and shall operate via battery back-up if AC mains are lost. The strip printer shall be UL 864 listed.
3. The system shall have a strip printer capable of being mounted directly in the main FACP enclosure. Alarms shall be printed in easy-to-read RED, other messages, such as a trouble, shall be printed in BLACK. This printer shall receive power from the system power supply and shall operate via battery back-up if AC mains are lost. The strip printer shall be UL 864 listed.

2.5 SYSTEM COMPONENTS - ADDRESSABLE DEVICES

A. Addressable Devices – General

1. Addressable devices shall provide an address-setting means using rotary decimal switches. Addressable devices that require the address be programmed using a programming utility are not an allowable substitute.
2. Addressable devices shall use simple to install and maintain decade, decimal address switches. Devices shall be capable of being set to an address in a range of 001 to 159.
3. Addressable devices, which use a binary-coded address setting method, such as a DIP-switch, are not an allowable substitute. Addressable devices that require the address be programmed using a special tool or programming utility are not an allowable substitute.
4. Addressable devices, which use a binary-coded address setting method, such as a DIP-switch, are not an allowable substitute. Addressable devices that require the address be programmed using a special tool or programming utility are not an allowable substitute.
5. Detectors shall be intelligent (analog) and addressable, and shall connect with two wires to the fire alarm control panel Signaling Line Circuits.
6. Addressable smoke and thermal detectors shall provide dual alarm and power/polling LEDs. Both LEDs shall flash green under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed into steady red illumination by the control panel, indicating that an alarm condition has been detected. If required, the LED flash shall have the ability to be removed from the system program. An output connection shall also be provided in the base to connect an external remote alarm LED.
7. The fire alarm control panel shall permit detector sensitivity adjustment through field programming of the system. The panel on a time-of-day basis shall automatically adjust sensitivity.
8. Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72.
9. The detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature.
10. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL).
11. Detectors will operate in an analog fashion, where the detector simply measures its designed environment variable and transmits an analog value to the FACP based on real-time measured values. The FACP software, not the detector, shall make the alarm/normal decision, thereby allowing the

sensitivity of each detector to be set in the FACP program and allowing the system operator to view the current analog value of each detector.

12. Addressable devices shall store an internal identifying code that the control panel shall use to identify the type of device.
13. A magnetic test switch shall be provided to test detectors and modules. Detectors shall report an indication of an analog value reaching 100% of the alarm threshold.
14. Addressable modules shall mount in a 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box. An optional surface mount Lexan enclosure shall be available.

B. Addressable Manual Fire Alarm Box (manual station)

1. Addressable manual fire alarm boxes shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status. They shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.
2. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.
3. Manual fire alarm boxes shall be constructed of Lexan with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1.75 inches (44 mm) or larger.

C. Intelligent Photoelectric Smoke Detector: The intelligent photoelectric smoke detector shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.

D. Intelligent Thermal Detectors: The intelligent thermal detectors shall be rated at 135 degrees Fahrenheit (58 degrees Celsius) and have a rate-of-rise element rated at 15 degrees F (9.4 degrees C) per minute. A high heat thermal detector rated at 190 degrees Fahrenheit shall also be available. The thermal detectors shall connect via two wires to the fire alarm control panel signaling line circuit.

E. Intelligent Duct Smoke Detector: The smoke detector housing shall accommodate an intelligent photoelectric detector that provides continuous analog monitoring and alarm verification from the panel. When sufficient smoke is sensed, an alarm signal is initiated at the FACP, and appropriate action taken to change over air handling systems to help prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system. The Intelligent Duct Smoke Detector shall support the installation of addressable Photoelectric detector capable or being tested remotely.

F. Addressable Dry Contact Monitor Module

1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to one of the fire alarm control panel SLCs.
2. The IDC zone shall be suitable for Style B/Class B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
3. For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 2-3/4 inch (70 mm) x 1-1/4 inch (31.7 mm) x 1/2 inch (12.7 mm). This version need not include Style D or an LED.
4. For multiple dry contact monitoring a module shall be available that provides 10 Style B or 5 Style D input circuits.

G. Addressable Control Module

1. Addressable control modules shall be provided to supervise and control the operation of one conventional circuit of compatible Notification Appliances, 24 VDC powered, polarized audio/visual notification appliances.
2. The control module NAC may be wired for Style Y (Class B) with a current rating of and 3 Amps for Style Y;
3. Audio/visual power shall be provided by a separate supervised circuit from the main fire alarm control panel or from a supervised UL listed remote supply.

H. Addressable Relay Module:

1. Addressable Relay Modules shall be available for HVAC control and other network building functions.
2. The module shall provide two form C relays rated at up to 3 Amps resistive and up to 2.0 Amps inductive.
3. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary devices energize at the same time on the same pair of wires;
4. For multiple relay control a module shall be available that provides 6 programmable Form-C relays.

I. Isolator Module: Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC Class B branch. The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC loop segment or branch. At least one isolator module shall be provided for each floor or protected zone of the building.

1. If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the SLC. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.
2. The isolator module shall not require address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.
3. The isolator module shall provide a single LED that shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

J. Serially Connected Annunciator Requirements

1. The annunciator shall communicate to the fire alarm control panel via an EIA 485 (multi-drop) two-wire communications loop. The system shall support two 6,000 ft. EIA-485 wire runs. Up to 32 annunciators, each configured up to 96 points, may be connected to the connection, for a system capacity of 3,072 points of annunciation.
2. An EIA-485 repeater shall be available to extend the EIA-485 wire distance in 3,000 ft. increments. The repeater shall be UL864 approved.
3. Each annunciator shall provide up to 96 alarm and 97 trouble indications using a long-life programmable color LED's. Up to 96 control switches shall also be available for the control of Fire Alarm Control Panel functions. The annunciator will also have an "ON-LINE" LED, local piezo sounder, local acknowledge and lamp test switch, and custom zone/function identification labels.
4. The annunciator may be field configured to operate as a "Fan Control Annunciator". When configured as "Fan Control," the annunciator may be used to manually control fan or damper operation and can be set to override automatic commands to all fans/dampers programmed to the annunciator.
5. Annunciator switches may be programmed for System control such as, Global Acknowledge, Global Signal Silence, Global System Reset, and on/off control of any control point in the system.
6. An optional module shall be available to utilize annunciator points to drive EIA-485 driven relays. This shall extend the system point capacity by 3,072 remote contacts.
7. The LED annunciator shall offer an interface to a graphic style annunciator and provide each of the features listed above.

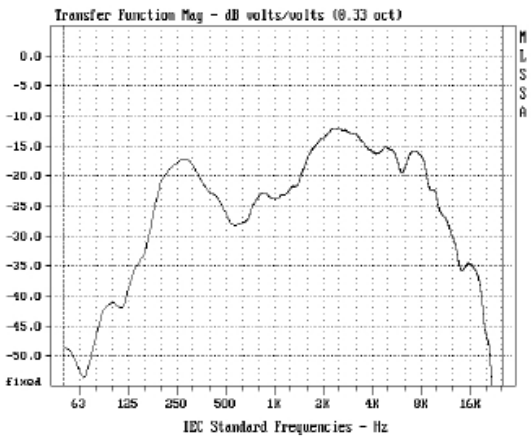
K. Speakers

1. The speaker shall be listed to UL 1480 for Fire Protective Signaling Systems. It shall be a dual-voltage transformer speaker capable of operation at 25.0 or 70.7 nominal Vrms. The speaker shall have a frequency range of 400 to 4,000 Hz and shall have an operating temperature between 32°F and 120°F. It shall mount to a 4 x 4 x 2 1/8-inch back box.
2. A universal mounting plate shall be used for mounting ceiling and wall speaker products. The notification appliance circuit and amplifier wiring shall terminate at the universal mounting plate.
3. Speakers shall be plug-in and shall have the ability to check wiring continuity via a shorting spring on the universal mounting plate. The shorting spring shall also provide tamper resistance via an open circuit if the device is removed. Speaker design shall isolate speaker components to reduce ground fault incidents.
4. The speaker shall have power taps (from ¼ watt to 2 watts) and voltage that are selected by rotary switches. All models shall have a maximum sound output of 86 dB at 10 feet and shall incorporate an open back construction.
5. All notification appliances shall be backward compatible.

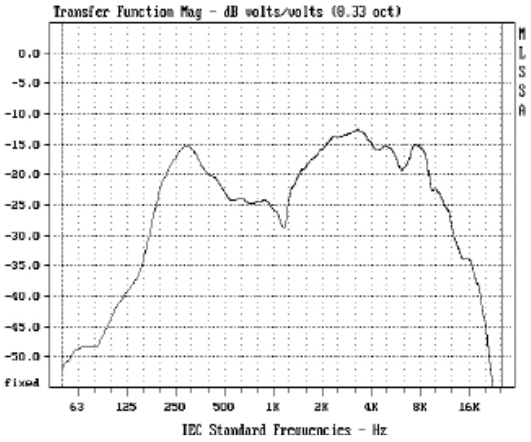
Ceiling Speaker

Wall Speaker

Wide Band Frequency Response



Wide Band Frequency Response



Note: The wide band frequency response is derived using MLS methods

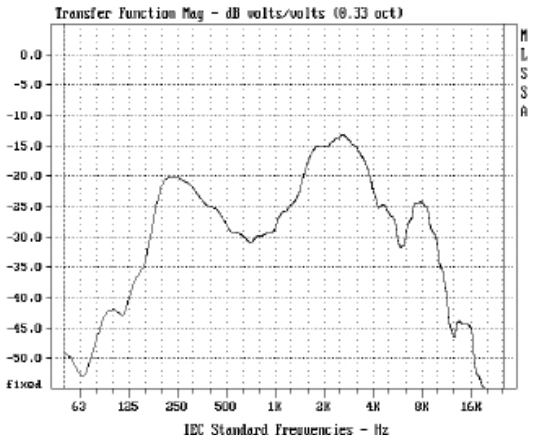
L. Speaker Strobes

1. The speaker strobe shall be listed to UL 1971 and UL 1480 and be approved for fire protective signaling systems. It shall be a dual-voltage transformer speaker strobe capable of operation at 25.0 or 70.7 nominal Vrms. The speaker shall have a frequency range of 400 to 4,000 Hz and shall have an operating temperature between 32°F and 120°F. It shall mount to a 4 x 4 x 2 1/8-inch back box.

2. A universal mounting plate shall be used for mounting ceiling and wall speaker strobe products. The notification appliance circuit and amplifier wiring shall terminate at the universal mounting plate.
3. Speaker strobes shall be plug-in and shall have the ability to check wiring continuity via a shorting spring on the universal mounting plate. The shorting spring shall also provide tamper resistance via an open circuit if the device is removed. Speaker strobe design shall isolate speaker components to reduce ground fault incidents.
4. The speaker strobe shall have power taps (from ¼ watt to 2 watts) and voltage that are selected by rotary switches. All models shall have a maximum sound output of 86 dB at 10 feet and shall incorporate an open back construction. The strobe shall consist of a xenon flash tube with associated lens/reflector system and operate on either 12V or 24V. The strobe shall also feature selectable candela output, providing options for 15 or 15/75 candela when operating on 12V and 15, 15/75, 30, 75, 110, or 115 when operating on 24V. The strobe shall comply with NFPA 72 and the Americans with Disabilities Act requirement for visible signaling appliances, flashing at 1 Hz over the strobe's entire operating voltage range.
5. All notification appliances shall be backward compatible.

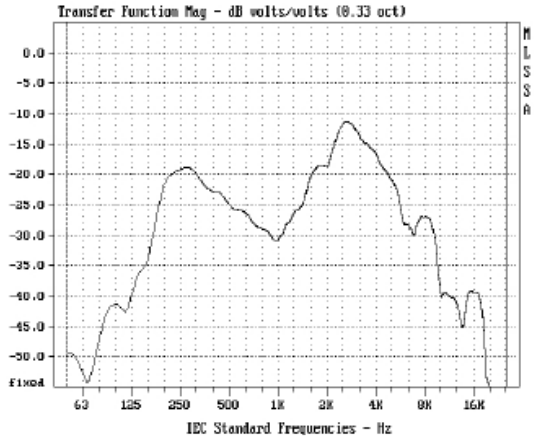
Ceiling Speaker Strobe

Wide Band Frequency Response



Wall Speaker

Wide Band Frequency Response



Strobe

Note: The wide band frequency response is derived using MLS methods

6. Strobe lights shall meet the requirements of the ADA, UL Standard 1971and be fully synchronized.

PART 3 - EXECUTION

3.1. INSTALLATION:

A. Installation shall be in accordance with the NEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.

B. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.

C. All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.

D. Manual fire alarm boxes shall be suitable for surface mounting or semi-flush mounting as shown on the plans, and shall be installed not less than 42 inches (1067 mm), nor more than 48 inches (122 mm) above the finished floor.

3.2. TEST:

The service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment shall be provided to technically supervise and participate during all of the adjustments and tests for the system. All testing shall be in accordance with NFPA 72.

A. Final testing shall be coordinated with the district and Sonitrol monitoring company.

B. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.

C. Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.

D. Verify activation of all waterflow switches.

E. Open initiating device circuits and verify that the trouble signal actuates.

F. Open and short signaling line circuits and verify that the trouble signal actuates.

G. Open and short notification appliance circuits and verify that trouble signal actuates.

H. Ground all circuits and verify response of trouble signals.

I. Check presence and audibility of tone at all alarm notification devices.

J. Check installation, supervision, and operation of all intelligent smoke detectors using the walk test.

K. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.

L. When the system is equipped with optional features, the manufacturer's manual shall be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

3.3. FINAL INSPECTION:

A. At the final inspection, a factory-trained representative of the manufacturer of the major equipment shall demonstrate that the system functions properly in every respect.

3.4. INSTRUCTION

A. Instruction shall be provided as required for operating the system. Hands-on demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.

B. The contractor and/or the systems manufacturer's representatives shall provide a typewritten "Sequence of Operation."

END OF SECTION